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Marine Propulsion; or the Influence of "Form" in Propelling Blades.

By THOMAS EWBANK, Washington, D. C.

A conviction that the principles of propelling, partially unfolded in the experiments first reported in the Journal,* and embodied in the Patent Office Report, of 1849, must eventually be recognised, induces me to offer the following remarks on the subject:

An increase of speed in ocean steamers is of acknowledged importance to the commercial and social interests of the world. Is it attainable? Yes; for no truth is more certain, though it may not be perceived, or but dimly perceived, that every acquisition in the arts is a step in the order of progression that serves, or ought to serve, as a fresh starting point to enable us to keep rising in mechanical knowledge and in its applications. How, then, is it to be achieved? Not by blind experiments, which have been tried long enough. In common with the lower tribes, we can meet exigencies in the arts with instinctive devices, and continue to meet others by the suggestions of experience; but there is a limit to empiricism, and then, in order to advance, an appeal to principles becomes necessary, because new bases of operation are wanted, which are not obvious to sense, and which nothing but an investigation of principles can disclose. To some extent this is, I think, applicable to steamers. There is an element in the propulsion of vessels that has hitherto been overlooked, and upon it, I believe, the next step in advance must be based.

* See Volume XVII, p. 42.

I wish to urge the value of *form* in propelling blades; for I am sure that in it is to be realized the desideratum of speed. A correct outline is every thing in those instruments, because every desirable quality *flows from it*—qualities which it is impossible to realize with the old rectangular planks in common use. I question if a grosser example of neglect of form than these present can be named, or where the consequences have been so serious—examples of greater looseness about principles and greater persistence in malpractice. Among the higher or even lower classes of machinery few such deviations from rectitude can be found, and fewer still that have been so long borne with. But it has happened to them, as to other characters whose proclivities to wrong-doing are innate—they have been endured till a sense of their deformities has vanished.

Though we may bungle along with misshapen blades, we cannot elude the penalties attached to them—as great waste of power, unnatural wear and tear, constant straining of the vessel, no marked increase of speed, and a premature breaking up of the whole. Of this severe punishment for neglect of form the history of steamers is replete; but, unfortunately, offenders are insensible to the offence and to what it costs them. This is not, however, the case in all things; and hence, while steamships still spend much of their costly power for naught; while their wheels continue uselessly to thrash the water and heave up tons over them; while their machinery is jarred and their massive shafting now and then wrenched apart by excessive strainings, the hulls are not kept in such violent and ceaseless paralytic tremblings as formerly. Modern vessels outstrip former ones because their outlines have been improved, and when equal efforts are made to improve those of propelling blades, steamers will begin to be what they ought to be.

Admitting that much is to be done in the construction of vessels and in motive machinery, their rate of going must continue to depend on their propelling apparatus. While it is defective, fleetness is unattainable, though all things else were perfect. The finest formed flyers move heavily with crippled wings, and we can have no swift skimmers of the seas with deformed organs of motion. Believing, as I do, that success is to be found in the true form of propelling blades, the following observations are submitted to marine engineers. Should they conclude that there is nothing in them, nor in the simple proposition itself, I would ask in what direction do *they* expect to succeed? On what other parts of a steamer do they propose to operate? On the hull, the boiler, the engine, or the wheels? On the number, width, depth, and dip of the buckets, &c.? Surely, on these points nothing decidedly new or promising can be expected, much less the development of *new elements* of propulsion; for, after all, that is what is wanted. The squeezing out, by extraordinary exertions, of a few more feet or rods to the hour will not satisfy the present age, let alone future ages. It would only show that the virtue of the present paddle is exhausted; that nothing, or next to nothing, more is to be got out of it.

But are new elements of speed to be elicited from the mere shape or outlines of the blade? Yes. But paddle-blades have long been experimented on, and the result has led to the universal preference of the ori-

ginal rectangular slabs, and to the recognition of the primitive wheel as "the prince of propelling devices for speed?" True, and the fact is conclusive that the existence of virtue in the *form* of the buckets is not suspected. It is not sought for, and consequently not found. Planks were the readiest forms and materials at hand in the beginning, and were with little reflection adopted, just as they have been continued. It is demonstrable that the highest attainable speed is impossible with paddle-planks, utterly impossible, and that it can only be attained in connexion with other engineering desiderata; such as the least waste of power, the least amount of material in the blades, the diffusion of the resistance over their entire surfaces, every section producing equal effects though very unequal in area, the centre of resistance not at the extremity but in the centre of the blade, and thereby putting the least strain upon the arms or levers. When these properties and the utmost *thinness* in blades, their smooth working, freedom from liability to sudden or increased strains are acquired, the true form will have been obtained, and, what may appear problematical to many, they will be found to have proceeded from it—illustrating a cardinal truth in physics, that in proportion as a device approaches the truth in form, it approaches it in every other particular.

It is, however, a melancholy fact that there is among our engineers a prevailing indifference to and unbelief in the value of form, which can only be ascribed to their not having looked into the subject. They do not perceive how two blades of equal areas, but differing in their outlines, should possess different properties; surface, not boundaries, being what they rely on.

That there is an innate relationship between cause and effect, and that the latter is modified by the instruments through which the former acts, is obvious to every body. A blunt, that is, a badly formed tool, consumes more power than a sharp one, and gives inferior results; so it is with every thing through which force is conveyed. Mechanical science rests upon principles that determine forms and proportions. *There is of necessity a best form for every thing and for every purpose.*

What, then, is the form of propelling-blades which communicates properties not found in common ones? In general terms, it is that which is exemplified in Nature's blades. The law that determines them makes them *long*, *narrow*, *tapered*, and *pointed*, and contracts and expands these features as speed is to be diminished or increased. The form and application, are antipodal to rectangular buckets, because the blade must taper as it dips; the deeper it enters the water the narrower it must become.

The effects of this simple change of form are as surprising as they are important. The most essential attributes of a propeller are evolved.

1. *The least amount of material in the blades.* They are not made uniform in thickness, but are thinned away towards their extremities, a feature incompatible with rectangular blades.

As the reduction of thickness of natural blades outwards is a permanent feature under all circumstances, it might have been inferred from that fact that the same trait might be indispensable to success in artificial propulsion. It has not been so inferred, and we are therefore led at once to inquire why natural blades are reduced outwards and to a mere

film? Because length of stroke virtually *diminishes with thickness*, and *a waste of power keeps pace with it.* This is demonstrated in our paddle-wheels. If a pair of these were made in the form of close drums or solid cylinders, they could of course have no propelling power whatever; no more than have grindstones revolving in their troughs. Suppose half of each removed and the usual number of arms and buckets or blades put in their places, the wheels, as they might then be called, could have only half the usual power; and if one-third, one-fifth, or any other proportion of the cylinder were left; in the same proportion would their capacity for propulsion be neutralized. It is, therefore, an inexpugnable truth that whatever may be the number of blades in a wheel, the sum of their thickness must be deducted in every revolution from their sweep through the water, in order to determine their propelling capacity or the work they should perform. In the supposed case of half the wheels being solid, the semi-cylindrical masses were simply distorted blades.

Taking the mean thickness and number of the massive planks that constitute the blades of ocean steamers, they lose from this cause from eight to ten feet of stroke in every turn of each wheel. Assuming two hundred and fifty thousand revolutions as the average number in a trip across the Atlantic, over five hundred miles of stroke are thus lost in each wheel; or, in other words, between twenty and thirty thousand pounds of timber are whirled that distance through air and water, and to no purpose but consuming power and wearing out the motive machinery. We may commit all manner of delinquencies in construction, but we cannot harmonize a philosophical truth with an opposite error. *Thinness* of blades and the *least material* in them, and the consequent least expenditure of power, depend upon form. There is no separating them. Instead of being tapered away toward their extremities as in natural instruments, ordinary blades are made as blunt there as any where else. They are, in fact, often made thicker by bolting on additional slats, and, they require this, since the resistance is accumulated there.

2. In the *reduction of the number of blades.* The adoption of tapered ones would enable us to throw overboard two-thirds or three-fourths of the number now used, with the same proportion of shafting, as not simply useless, but positively injurious. This cannot be done with the present blades, on account of the jarring caused by their violently slapping the water as they come down upon it. When few blades are used the effects of this are seriously destructive; and hence to reduce the concussion the number is increased, on the principle of dividing a few large blows into many little ones. Some boats have had seventy-two blades, on each wheel; many have now thirty-six. Thus one error called in another, for it was not perceived that as their number was multiplied their efficacy was diminished.

A correct form would have removed the evil at once and the cause of it. Instead of a propelling surface, extending from twelve to fifteen feet from a vessel's side, being brought in sudden conflict with a wave, a mere point of the blade would have been presented to it. Instead of attempting to arrest the swell, and be shaken or carried away by it, it would go softly and silently into and through it.

3. In *removing the centre of pressure* from near the extremity *to the centre of the blade*, and in an *equable distribution of pressure over its face.* It is the characteristic of a good and durable instrument that its material is so distributed that every part contributes its due proportion of influence towards the intended result, *and no more.* No other criterion than this is required to determine degrees of worth or worthlessness. How is it with rectangular blades? Why, in truth, it must be admitted that in this respect they are defective, and to a degree which I suspect can hardly be paralleled in modern mechanism. Their lower parts, sweeping through greater spaces in the same time than those above them, do most of the work, nearly all of it, and thus destroy the equilibrium of pressure on the face of a blade, which, *above all things* else, should be secured, and introduce an element of destruction that reaches from them to every thing connected with them. One-third of a steamer's blades have been removed from their upper parts without diminishing in the least her speed; a result that might safely be predicted of some boats now running.

An equable distribution or equilibrium of pressure on a surface whose several sections are immersed at unequal depths and moved with unequal velocities might seem impossible on a first thought; but a second one would suggest that there must be, *per se*, some provision of the kind for this class of movements, as there are for others, and that, too, by varying the outlines of the surface without enlarging it—a principle equivalent to that exemplified in the lever by simply moving the fulcrum; and in fluids to that by which a pint of water may be made to balance a gallon or a thousand gallons; THE principle in fact which raises or lowers the centre of pressure on a blade, not by adding anything to it, but by merely widening or narrowing it—*which modifies velocity by surface and surface by velocity*, so that every portion meets only its proper amount of resistance, and all portions harmonize in bringing out one result.

4. Another beautiful result is, that though the blades may taper to a point, a section near that point does just as much work as an equal section through the widest part: extended sweep compensating for diminished surface.

Such are some of the results of form in propelling blades, and they are what are now wanted to enable us to begin a new career in ocean steamers.

Variously shaped blades have been tried on the stern submerged propeller, but for them no definite form has been developed. Most of them are as wide of the truth as the planks of side-wheels. The resistance is accumulated at their extremities; the largest extent of surface is there, and consequently the greatest strain upon the levers or arms and shafts. The true form, whether worked at the side or stern of a vessel, is only to be determined by the properties named, and, as already remarked, they are applicable to every propeller. The law makes no discrimination in favor of one application over another.

The blades of *oars* partake of the same defect as those of steamers' wheels, though in a less degree, because of their being applied in the direction of their length, instead of being attached across the ends of their levers. Uniform in width, the parts farthest from the centre of motion move with greater velocity than the rest, and hence it is the end of an

oar that does most of the work: portions in the rear move slower than it—they are *behind* it in their action and cannot therefore sympathise or coalesce with it. In some oars the ends of the blades are wider than the other parts, when the defect is still greater.

To enable an oar blade to return an equivalent for the power transmitted, it should diminish in width from near the middle of its length, and in such a ratio that every part may perform an equal proportion of work, and in *unison* with every other part. In the common blade, A, the centre of resistance from the water is near o; but let *the same amount of surface* be formed like B, and the centre of resistance would be at the same distance from the centre of motion, while the end of the blade would be thrown further out, and greater effects obtained by the same power. Every section, from the middle of the blade to the pointed extremity, would then be equally effective, though so unequal in area, because its surface, multiplied by its velocity, would give the same resultant as every other section. In such a blade, no part could embarrass the perfect action of any other part. All would be in accord.

The object of the foregoing remarks is to awaken attention to a problem in practical science, than which there are few of greater and none of more immediate value.

It is greatly to be desired that the Government would institute, through a commission, a series of experiments to determine the true forms and proportions of propelling blades. The report would be of permanent, and world-wide interest.

For the Journal of the Franklin Institute.

Description of Atherton's Patent Steam Engine. By H. Howson, C. E., Philadelphia.

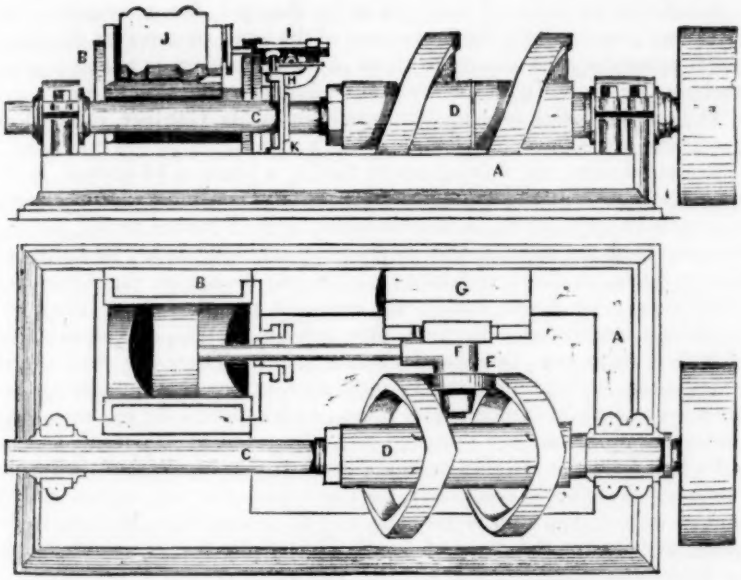
The annexed engraving represents in an elevation and ground plan, Atherton's steam engine, the novelty of which, consists in producing a rotary motion from the rectilinear movement of a piston rod without the intervention of a crank. No little ingenuity has been expended in endeavoring to produce a substitute for the crank, and from time to time, appear contrivances and propositions to effect that object, without making any inroads in the practice of engineers, however, who continue to adhere with excusable pertinacity to the old-fashioned time-honored movement.

No sooner is a new device brought before the notice of the public, or a new scheme proposed to take the place of what must still be deemed an efficient means of producing a rotary motion, than after a few efforts at notoriety it expires, its brief existence being little known beyond a passing notice of some periodical or the exhibition of a miniature model.

It is not, therefore, much to be wondered at, that practical men are apt to look with an eye of suspicion on all such innovations, and to treat with incredulity, attended, doubtless, with no little prejudice, any attempt to discard their favorite crank.

Against all these influences, Mr. Atherton has had to strive in bringing his invention before the public, no little credit being due to that gentleman for his earnest endeavors to give it a thorough practical test. Without being content with the results of a model, which in few instances can be considered a fair experiment in developing the true effects of any new machine, he has had an engine of considerable size built, and proved its efficacy as compared with an ordinary crank engine.

Without speculating as to the ultimate result and general success of Mr. Atherton's engine, the writer will at once refer to the following outline description of the machine, and of its actual performance as brought immediately under his notice, leaving it for more experienced engineers to deduce their own theories, and arrive at their own conclusions. Whatever the result of their investigations may be, favorable or otherwise, every credit is none the less due to the inventor for the perseverance with which he brought his contrivance to a practical bearing, and for the manner in which he has courted the examination and opinions of the public.



A, is the base plate, to which is secured a cylinder, B, with piston, piston-rod and slide valve of the common construction. C is the shaft, which takes the place of the ordinary crank shaft, placed, however, longitudinally with the cylinder, instead of at right angles to it, as in other engines.

At the end of this shaft, furthest from the cylinder, is what may be termed a double scroll cam, D, formed of two curved rings connected by arms to a central hub. The curves of these rings are of the shape of a screw, with a pitch of 14 inches, one-half of each ring, however, represents the thread of a right handed, the other of a left handed screw; in other words, the course of the thread after traversing half the circumfer-

ence, instead of pursuing the regular inclined course of an ordinary screw, returns the same way, assuming the form represented in the engraving.

Between the two rings works the roller, E, attached to the cross-head, F, which is secured to the piston-rod in the usual manner, and slides on the permanent guide, G. It will be evident that as the roller is moved backwards and forwards by the steam cylinder, its pressure against the inside of one or other of the rings, must cause the same to turn, the reversed direction of the incline on the rings, producing a continuous rotary motion.

The peculiar situation of the shaft, in regard to the position of the cylinder, rendered it necessary to substitute some driving apparatus for the valves instead of the ordinary eccentric.

The inventor's ingenious contrivance, consists in attaching to the shaft, C, a rod, K, with inclined planes at each end; the latter, as the shaft revolves, pass between two small rollers, on the flat portion, I, of the valve rod, the amount of movement being regulated by the degree of inclination of the planes.

Should the direction of these planes be changed, the movement of the valve and consequently the movement of the shaft changes its direction; a neat apparatus, too minute to show in the engraving, is adapted to the machine, for instantly and without any effort effecting this purpose.

The engine before represented, was built by Mr. Gardner, of Haydock Street, for Mr. James Barclay, and has a cylinder 8 inches bore, and 7 inches movement, the driving screw having a pitch of 14 inches. In the same shop where this engine is erected, is an ordinary vertical crank engine, with cylinder $6\frac{1}{4}$ inches diameter, and 18 inches stroke, making 70 revolutions per minute, and driving two screwing lathes for bolts, one tapping lathe, two turning lathes for bolts, one blower for eight fires, one small blower for steam boiler, six ordinary machine shop lathes, one grindstone, one drilling machine, four polishing lathes, one jig saw, one 14 inch circular saw, two wood turning lathes. These the shop engine turned with facility, until the 14 inch circular saw was brought to operate upon a piece of 3 inch cherry plank, which caused the engine to stop. The steam pipe was then removed and connected to Atherton's engine, and a belt from the driving pulley passed to the crank shaft, when the whole of the above machinery, together with the old engine and its pumps, were driven with facility and with no perceptible difference in the speed, even when the piece of 3 inch cherry plank was operated upon by the circular saw.

Such was the extraordinary result obtained, a result unexpected by all who had examined the model, as well as the engine itself.

A slight jar was observed, as the roller passed the point where the incline of the screw reverses; this may be attributed in some measure, however, to the imperfect manner in which the engine was screwed to a temporary foundation, and to the fact, that several of the parts were slightly built, causing a spring, which in the next engine will be obviated by adding considerably to it in strength of metal.

The engine in question has been forwarded to England by the owner, Mr. James Barclay, who is about to have another built of the same dimensions, in order still further to test its powers, when those interested in such matters will have opportunities of witnessing the experiments.

Storms' Cloud Engine.

We have already published in this Journal, (Vol. XXVIII, page 343, Third Series,) a brief account of this engine, from the pen of WM. H. SHOCK, Esq., U. S. N. The following extract from the *New York Tribune*, gives an outline of the principles on which the apparent gain obtained by the combination of air and steam over those from steam alone, is explained. The experiments alluded to in the concluding paragraph were conducted, we believe, under the superintendence of CHAS. W. COPELAND, Esq.

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Mr. Wm. Mount Storms, of this City, a gentleman apparently well versed in all that relates to these interesting and extensive subjects, professes to have made new discoveries or applications of natural laws, which are to result in increasing the efficiency of a given amount of fuel in the steam-engine. The company formed to carry out and apply the intentions of Mr. Storms, have subjected the theory to the test of several expensive experiments, and one engine of respectable size constructed on this plan, has been for some months in actual daily use, driving the fans and other machinery of a small foundry and machine-shop. The plan consists in mixing cold air with ordinary steam. It is assumed that in addition to the familiar forms of ice, water, and steam, the aqueous element is capable of existing in a state of vesicular vapor, or opaque steam, a form more familiar to the eye than the transparent steam, but never before suspected of possessing any mechanical power above or even equal to that of the latter.

If a glass bull's eye be introduced in the top or side of an ordinary steam-boiler, the steam within is found to be perfectly transparent and invisible. But on turning a cock the escaping steam is found to be white and cloud-like. This is due to the cooling effect of the air, which mixes with, and apparently condenses it. Mr. Storms's experiments lead him to the conclusion, that the volume of the whole is increased by the combination, and this to a very considerable degree, as high under favorable circumstances as 75 per cent., and consequently affording a corresponding increase of efficiency in an engine. If common air be compressed and introduced at an ordinary temperature, into a vessel containing steam at the same pressure, the following effects may be anticipated. On the one hand a portion of the steam will be condensed and changed to water, which will diminish the pressure; but on the other hand the air will be heated and expanded; and these two effects may be supposed very nearly if not exactly to balance each other. But the experiments alluded to indicate a very decided increase of volume, provided there is a sufficient difference of temperature. If pure transparent steam be mingled with air, previously heated to the same degree, none of this expansion is experienced, and it becomes a question how to compress air in a pump, and convey it in a cold state into a heated cylinder.

Mr. Storms avoids the solution of this difficult problem, by allowing the air to mix thoroughly with the steam, at any temperature it may chance to have, cooling it afterwards by expansion. In other words, he mixes hot or warm air with the steam in the steam-chest, and does not expect the mixture to assume the cloud form, until it commences to expand in

the cylinder. The act of expanding cools both steam and air, but in very different proportions. Pure steam of a high pressure, (say 60 lbs.) has a temperature of about 310° F., and if cut off at half-stroke, so as to double its volume by expansion, cools down to only about 270°, while air at the same temperature, if expanded to the same extent, cools down to about the freezing point. Thus the combined fluids may readily be compelled by expansion, to assume the form of cloud or vesicular vapor, if the presence of air at a different temperature be the only condition necessary. To accomplish this object in an ordinary horizontal engine, Mr. Storms has, in the instance above referred to, placed a double-acting air-pump near the cylinder, and allows it to discharge into the steam-chest just above the valve. As the first portion of the stroke of the pump is spent in simply compressing its contents, it is so timed that it will begin to deliver with the commencement of the stroke of the piston. The pump is enveloped in a jacket of cold water to keep it cool, and the air probably enters the steam-chest at a temperature of from 180° to 250°.

A series of experiments have been lately tried at the Novelty Works on a tolerably large scale. The engine was run first with steam alone, and then with the cloud combination, the resistance being constant in all cases. The revolutions produced per lb. of coal were as follows: Steam 107, cloud 190; showing a great advantage by the use of the cloud vapor.

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*Miles's Hydrostatic Railway Brake.**

The Shrewsbury and Hereford Railway has just been the scene of an interesting trial of this invention, under the auspices of several eminent railway authorities and men of science. The testing train left the Shrewsbury station at 12·30, arrived at the city at 2·40, stopping at the usual stations on its way. The patent brake alone was used during the journey, and upon the arrival of the train at this station, a number of experiments were tried upon different portions of railway, principally to ascertain the distance and time in which a train could be arrested. Notwithstanding the usual drawbacks to working all new inventions, the train was easily stopped, when going forty miles per hour, in 300 yards, the usual distance with the ordinary brakes being about 1750 yards. Colonel Kennedy and other gentlemen, who tried these tests, expressed a strong opinion that, with the slight enlargement of the tender cylinder, pointed out by Mr. Miles, a train would be stopped with ease in three yards to the mile; that is to say, a train going forty miles per hour would stop in 120 yards. The experimental train left this city, with the usual mails and passengers, at 6·45, and arrived at Shrewsbury at 9·15, using the patent brake during its course, still proving itself most effective. The brakes themselves are upon the usual principle, but are placed upon every carriage, instead of on one or two only. A cylinder is fixed under the carriage, 4½ inches diameter and 3 inches stroke; and in this cylinder is fitted a solid piston, the rod of which is attached to the lever of the brake. Into each side of the cylinder is screwed an iron tube, one inch in diameter, and terminating, at each end of the carriage, with a joint of a novel character.

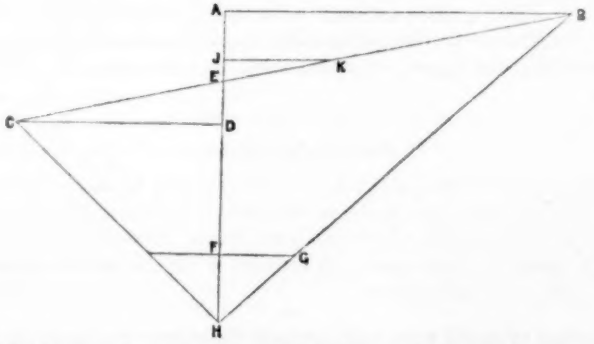
* From the Lond. Pract. Mech. Journal, June, 1855.

When the carriages are connected, the tubes are made continuous by inserting into these joints a flexible tube between each carriage: and when the engine is attached to the train, that is also connected by a flexible tube, leading into tubes fixed in the bottom of the tender, which tubes are merely for the purpose of reducing the temperature of the water used in applying the brakes. The boiler is fitted with a stop-cock near the starting lever, and from this cock is a tube connected to the tubes in the tender. When a train is made up, and the engine attached, a cock inside the tender is opened, and the tubes throughout the train are allowed to fill themselves with water; water being only compressible to the extent of 1 inch in 15,000, is always ready to be acted upon at the moment. At the present day, locomotives are worked at a pressure of from 100 to 150 lbs. per square inch; but for example's sake, we will take the lowest figure; therefore, with the cylinders before described, a power of 1500 lbs. is given to each brake, no matter what may be the number of carriages in the train. The cylinder to work the tender brake is $4\frac{1}{2}$ inches diameter, with a 6 inch stroke, and gives a force of 3000 lbs. The mode of bringing the brakes into use is this:—The engine driver shuts off his steam, opens the cock named in boiler, and in one second, the whole of the brakes are on the wheels, and are taken off by the driver shutting the cock in the boiler, and opening the one in the tender.

For the Journal of the Franklin Institute.

To ascertain the Location of Slope Stakes in laying out Cuttings or Embankments for Railroads, Canals, &c. By R. G. HATFIELD, *Architect, N. Y.*

Let the required distances, AB and CD, equal x and y respectively; let the half of the road bed, FG$=a$; the observed height over the centre of



the road bed, EF$=h$: the ratio of the slope of the cutting, BG,$=1 : s$, as seen in the proportion FG : FH : : 1: $s=\frac{\text{FH}}{\text{FG}}$, and from which FH $=$ FG.$s = as$. In like manner let the ratio of the grade CB $=1 : g$, thus— JK : JE : : 1: $g=\frac{\text{JE}}{\text{JK}}$ and by similar triangles, AB : AE : : $1 : g$, from which AE $=$ AB. $g=gx$; the difference of level of the two points, E and K, having been ascertained by the instrument, and the point, K,

taken at pleasure; although if JK = 10 feet, the calculations will be simplified.

By similar triangles FG : FH : : AB : AH $= \frac{FH \times AB}{FG} = \frac{asx}{a} = sx.$

Again; AH = AE + EF + FH $= gx + h + as,$

and since AH, also $= sx \therefore sx = gx + h + as,$

from which, $sx - gx = h + as = (s - g)\,x,$

and $x = \frac{h + as}{s - g}.$

For the other side, DH = CD. $s = sy.$

ED = CD. $g = gy.$ EH = ED + DH $= gy + sy.$

Also, EH = EF + FH $= h + as.$

$\therefore gy + sy = h + as = (g + s)\,y,$

and $y = \frac{h + as}{s + g}.$

Which is identical with the former, excepting the change of the sign in the denominator. The quantities a and s, it will be observed, are *constant*, throughout all the sections of the same cutting, and hence the formula is quite simple.

Example.—Let $h = 19{\cdot}65$, $a = 10$, FH $= as = 7{\cdot}5$, hence $s = 0{\cdot}75$.

JK $= 10$, JE $= 2{\cdot}5$, hence $g = 0{\cdot}25$.

Then $\frac{h + as}{s - g} = x = \frac{19{\cdot}65 + 7{\cdot}5}{{\cdot}75 - {\cdot}25} = \frac{27{\cdot}15}{{\cdot}5} = 54{\cdot}3$

And $\frac{h + as}{s + g} = y = \frac{27{\cdot}15}{{\cdot}75 + {\cdot}25} = 27{\cdot}15.$

In corroboration; AE $= xg = 54{\cdot}3 \times {\cdot}25 = 13{\cdot}575$

AH = AE + EF + FH $= 13{\cdot}575 + 19{\cdot}65 + 7{\cdot}5 = 40{\cdot}725$

Also, AH = AB. $s = xs = 54{\cdot}3 \times {\cdot}75 = 40{\cdot}725.$

And so for the other side, DH, is found $= 20{\cdot}3625.$

By inverting the figure, its application to embankments will readily be seen.

New Motive Power.

The following extract from the *New York Tribune*, will be read by engineers with interest. We are assured by a friend in New York, competent to form a correct judgment, that the account of the experiments given therein is correct, and that an application is to be made on a scale sufficiently extended to test the practical value of bi-sulphuret of carbon as a motive power. COM. PUB.

An engine of small size, analogous to the steam engine in its structure and mode of operation, but producing considerable more power by the employment of a different fluid, the "bi-sulphuret of carbon," has been recently on exhibition in room No. 17, Bank of the Republic Building, in this City. Numerous and varied experiments seem to furnish indubitable proofs that this hitherto unimportant fluid (produced in any quantities by passing the vapor of sulphur through charcoal) possesses the long-sought quality of expanding into vapor of a given volume, and thus producing a given amount of mechanical power without the expenditure

of as much heat as in generating the same quantity of steam. This is proved by working the engine alternately by steam and bi-sulphuret, (taking care to provide against any transfer of heat from one to the other,) and observing the power developed in either case with the same fire and the same boiler. The result is uniformly and unequivocally in favor of the new fluid, as worked in this particular engine and under these particular circumstances. A larger engine, rated at six horses power, is reported to have been for some time in operation in a distant portion of the State with the same results; but of this we cannot speak with the same degree of certainty. The engine now exhibiting is in the form of an ordinary horizontal stationary cylinder, $2\frac{1}{4}$ inches diameter, stroke of piston 4 inches. It is provided with a common short slide-valve like a locomotive, cutting off by the lap at about $\frac{3}{8}$ stroke from the commencement. It is accompanied by an upright tubular boiler, heated by a spirit lamp; and the vapor, whether of water or bi-sulphuret of carbon, is finally condensed by passing through a worm or coiled pipe in a vessel of cold water. No vacuum is attained by this condensation, the only object being to preserve the material. Resistance is applied by means of a friction brake, and the feed-pump is provided with cocks, so that either water or bi-sulphuret alone, or a mixture of these fluids, may be forced into the boiler; and it is found that the engine works considerably more rapid, and with a greater load on the brake, when fed with the new fluid than when fed with water. *How much* gain results from this substitution would require more careful experiments and much more time than we have yet devoted to this subject; but the fact of the gain is established beyond a shadow of a doubt. After running for a reasonable time with increased power by the aid of the bi-sulphuret, the engine can be again worked with steam at the same rate as before without interruption of its motion, showing that the operation has been conducted without loss of the heat previously stored in the water. The bi-sulphuret being decidedly more volatile than water, much care is required to treasure the heat to this extent while working with the new fluid; but it was unequivocally done in one instance at our request.

A fluid which expands into vapor with smaller consumption of heat than water has long been sought after as a motive agent. After water or any other fluid has been heated to its boiling point, it requires a great addition of heat to expand it into vapor. Alcohol, ether, and other liquids expand into vapor of a greater or less volume than water, and absorb, in so doing, a proportionally greater or less quantum of heat, so that it has come to be acknowledged as a law that the volume of any vapor is proportional to the heat absorbed, and consequently that no gain could be derived from substituting other liquids for water. Two fluids have been proved, however, to be exceptions to this rule. These are mercury and carbonic acid. Both these are or might possibly be more economical of fuel than water for an engine, but both have proved impracticable; the first by reason of the high temperature required (boiling at 620° Fah.) and its effects on the health of those employed about it; the second by reason of the low temperature and great pressure required for its condensation, (boiling at a temperature below zero,) as well as by its effects on the metals of the engine and boiler. The present discovery, on the

contrary, provides an agent boiling at 108° Fah. and capable of developing possibly a five or six fold power, as compared with steam, with no practical difficulties yet discoverable, except an unpleasant but harmless odor when allowed to evaporate in the air.

To prevent confusion, it may be well to distinguish between this principle and some of the other hopeful devices for economizing fuel. The caloric or air engines of Sterling, Ericsson, Wilcox, Bennett and others, do not attempt this method, but simply draw from the discharging pipe as large a quantity of its heat as possible, and transfer it to the receiving pipe. The compound engine of Du Trembley exhibited at the Novelty Iron Works, in this City, in 1852, and now running a French steamer on the Mediterranean, does not attempt this method, but extracts sufficient heat from the exhaust pipe of the steam engine to boil the ether at a lower temperature, and thus impel a second engine. The cloud engine of Storms does not attempt this plan, but by introducing air into the steam creates a fluid which operates more desirably than steam *after the* "*cut-off.*" In engineering language, it is only more economical "when worked very expensively." The vapor of bi-sulphuret of carbon has not yet been tested at any high grade of expansion; but should it be found by experiment to follow the same law as steam, the practical value of the fluid for this purpose seems to be almost incalculable. The credit of the discovery or invention, belongs to Mr. B. Hughes, of Rochester, in this State, who obtained a patent for this application.

AMERICAN PATENTS.

List of American Patents which issued from June 5, *to July* 3, 1855, (*inclusive,*) *with Exemplifications.*

JUNE 5.

1. For an *Improvement in Registering Blocks for Printing Oil Cloths;* James Albro, Elizabethtown, New Jersey.

Claim.—"The bar of straight edge with ⊤ shaped stops attached permanently to it, in combination with the guide screws in the blocks, and the recess in the right hand corners of the blocks, and smooth surface on the faces of the blocks."

2. For an *Improvement in Seed Planters;* Lucien A. Butts, Cuba, N. Y.

Claim.—"Raising the seed to be planted up in a cup or cell, vertically or nearly so, above the height of the grain in the hopper, and then tripping a valve in the cup or cell, and allowing the seeds contained therein to drop through a tube towards the ground."

3. For *Improvements in Burning Brick;* Daniel Blocher and George M. Blocher, Cumberland, Maryland.

Claim.—"The furnaces entirely within the casement and fed at the top, in combination with the close setting of the interior benches, by which, placing the fuel within the arches is avoided, and the burning of the kiln improved."

4. For an *Improved Ship Ventilator;* Ernest Bahr, Rochester, Indiana.

Claim.—"The helical tube provided with valves and guard plates. One end of the helix terminating above the deck in two parts, D E, the part E being provided with a wire wheel and wire cloth covering, said part, E, being movable, so that it may be turned to face the wind at all times."

5. For an *Improvement in Feeding Water to Steam Boilers;* Thomas Champion, Washington, D. C.

Claim.—"My invention consists in placing a hollow tube or tubes within the interior of the boiler above the water line, made to suit the form of the boiler, having many small exit apertures or fissures made through it at short intervals, so directed as to sprinkle all the inner surface of the boiler that is bare of, or is likely to become bare of water, while fire is acting on the opposite sides of the plates. Also, supplying steam boilers with all their water through a sprinkler that is connected with the lower water space and feed pipe by a valve at their junction, which allows the water that passes up through the sprinkler to jet the plates when the pump is not acting, and so long as any water remains in the boiler above the fire or feed pipe."

6. For an *Improved Arrangement of Drains for Sewers;* P. J. Coogan, Charleston, S. C.

Claim.—"My invention consists in the employment of siphons placed within a box or receiver, whereby the sewer or channel which extends from the box or receiver to the main sewer, is prevented from being choked or stopped with sediment or impurities, and all unpleasant and unwholesome effluvia, arising therefrom, avoided. Also, the box or receiver provided with siphons."

7. For an *Improvement in Seed Planters;* Charles H. Dana, West Lebanon, N. H.

Claim.—"The arrangement of the hinged vibratory mouth piece at the lower end of the staff, with the projecting portion of the front side of the seed box, and with the incision plate descending therefrom, in such a manner, that the downward sliding movement of the said staff upon the seed box will close the said mouth piece upon the incision plate, and from an incising planting receptacle for depositing the seeds in the ground, and an upward sliding movement of the said staff upon the seed box, will force open the said mouth piece, and leave the seeds in the extreme bottom of the incision formed by the said planting receptacle. Also, the arrangement by which I positively insure the opening of the mouth piece of the planting receptacle at each upward movement of the handle, viz: by means of the projecting portion of the plate which is secured to the seed box (or its equivalent)."

8. For an *Improvement in Washing Machines;* Lewis W. Colver, Louisville, Ky.

Claim.—"The washing of clothes by placing them in a crate, basket, or creel, which has a reciprocating motion through the suds or wash box, and, at the same time, a rotary motion around its own axis, by which means, the position of the clothes is constantly changing whilst they are forced through the water, and are washed without being rubbed or injured."

9. For an *Improvement in the Soak Pits of Brick Machines;* William H. Degges, Washington, D. C.

Claim.—"The revolving soak pit, or its equivalent, for uniformly soaking the clay when pulverized, and conveying it to a convenient position to be fed into the brick machine."

10. For an *Improvement in Brick Machines;* Wm. H. Degges, Washington, D. C.

Claim.—"1st, Causing the reciprocating bar to rest at each end of its travel, whereby ample time is afforded for inserting the moulds under the bottom of the pug mill, and for passing the clay into them while in their rest position. 2d, Inserting the moulds immediately under the centre of the pug mill, whence they are moved alternately to the right and left previous to being filled, whereby the size of the pug mill and the power required to work it, are economized to the fullest extent. 3d, Dusting the endless apron, or other device, for conveying the clay to the pug mill, with a mixture of coal dust and sand, whereby the clay is prevented from adhering thereto, and, at the same time, the coal dust is evenly mixed with the clay during its preparation. 4th, The series of brushes, or other device substantially the same, that will hold water, whereby the moulds are both cleansed and damped at the same time."

11. For an *Improvement in Reaping and Mowing Machines;* Andrew Dietz and John G. Dunham, Raritan, New Jersey.

Claim.—"Our present invention is generally similar to our former invention, and for which letters patent were granted to us bearing date 27th March, 1855, but greatly simplifies our said former invention, and also much increases the effective power of the mower or reaper, friction lessened, and the draft rendered easier. Also, the use, for the

purpose of transferring motion from the driving wheel to the cutter bar of a short lever, the centre of oscillation of which is over the cam flanch itself, the rollers being but a cam and a half apart, or its equivalent."

12. For an *Improved Mode of Securing Wash-Boards to Walls;* Thomas Estlack, Philadelphia, Pennsylvania.

Claim.—"Securing wash-boards to the flooring and to slides, which work in guides attached to the walls, or in an equivalent way, so that the wash-boards will, in case of the shrinking or settling of the flooring, fall, or settle with it, thereby causing the lower edges of the wash-boards and flooring to be at all times in contact."

13. For a *Method of Composing Music;* William Fischer, Philadelphia, Pa.

Claim.—"So arranging a certain number of musical phrases on each of a number of cards, that by selecting and combining one from each card, a number of musical and perfectly melodious pieces can be composed, all of them differing from each other."

14 For an *Improvement in Boot Jacks;* Franklin J. French, Whitingham, Vermont.

Claim.—"The spring wedge in combination with the lever and spring, or their equivalents."

15. For an *Improved Machine for Skiving Boot and Shoe Counters;* Luther Hill, Stoneham, Massachusetts.

Claim.—"Combining with the rotary cylinder bed or carrier its face, clamp, and arc cutter, the peripheral clamp and its cutter, the whole being arranged and made to operate so as to perform the function of beveling along the arc of one counter and the chord of another during one revolution of the said cylinder bed. Also, combining the arc knife or cutter, the cylindrical bed or carrier, and the clamp thereof, by means of mechanism, in order that such arc knife or cutter may adapt itself to a leather counter of any ordinary thickness held between the clamp and the plane surface of the cylindric bed, such means or mechanism being the rocker frame and the adjusting lever. Also, supporting the bifurcated or rocker frame by means of a rotary journal or clamp, or the equivalent thereof, so that the angular position of the knife with respect to the plane surface of the rotary carrier may be changed as circumstances may require."

16. For *Improvements in Grain and Grass Harvesters;* M. G. Hubbard, City of N. Y.

"My improvements consist in the direct connexion between the driving wheel and cutters, by means of a single shaft, the combinations and bracings of the driving parts with the frame, and the mode of forming the cutter bar, and affixing the cutters thereto, together with the form and construction of the cutter bar, and its connexion with the frame."

Claim.—"The employment of two fingers to each sickle blade, for the purpose of dividing the cutting force expended at each stroke of the cutter bar, and, also, preserving, more perfectly, the cutters from injury, by keeping stones, &c., from coming in contact therewith. I do not claim the general device of making bars of angle iron for the purpose of lightness and rigidity, but the making the cutter bar of angle iron for the purpose of attaining, at the same time, both the above advantages, and a shoulder against which to abut the knives, so that a single bolt to each will securely hold them."

17. For an *Improvement in the Process of Manufacturing Hats;* Lausing E. Hopkins, Brooklyn, New York.

"The nature of the invention consists in providing a new process of forming a bat, or hat body, a new process of bringing the same into a proper size, and a new process of sticking, scalding-in and beating up the nap of hats, the whole forming a complete plan of making hats, from blowing the fur to finishing the napped hat ready for dyeing, by means of a series of machines adapted to the purpose, making up a full process of manufacturing hats, whether fur or other material of suitable character be used, and, further, whether it is desired to make napped fur hats, felt hats, or the shell for bodies for plush hats."

Claim.—"The making a complete hat body by means of the manipulations and process described, including the forming, felting, or sizing, and the sticking, scalding-in, and beating-up of nap, without regard to the peculiar machinery which may be used to produce the combined result of beating, or otherwise manipulating in hot water, for the purpose of manufacturing a hat by a complete and continuous range of mechanical operations as a substitute for the dipping and rubbing on a plank by hand."

18. For an *Improvement in Floating Cabins for Steam and other Vessels;* Wm. R. Jackson, Baltimore, Maryland.

Claim.—"The construction of a deck or saloon cabin of a steam or other vessel, so that it shall admit of being separated from the hull, and form in itself an escape or life boat."

19. For a *Double Acting Pump;* Edwin A. Jeffery, Corning, New York.

Claim.—"Connecting the piston heads by a long tube having a short valve chamber near its middle with a single ball valve, the water passing alternately through each end of the tube and out at the sides of said valve chamber, the valve chamber being so short that the ball will exclude the water from one end by rolling only far enough to admit the water fairly at the other, while the piston heads are so far apart that the eduction port shall always be embraced between them."

20. For an *Improvement in Apparatus for Bleaching Rags;* Harrison Loring, Boston, Massachusetts.

"The nature of the invention consists in so arranging the induction pipe as to allow of the expansion and contraction of the bleach without affecting it. Also, the admitting of steam to all parts of the bleach at the same moment, which I effect by means of perforated pipes running lengthwise of the bleach; this prevents the rags from being forced compactly into one end of the bleach, (as they are when steam is admitted directly at any one point, as has been done heretofore,) and allows, by the equal distribution of the rags, the bleaching liquor more thoroughly to perform its functions. Also, in introducing the induction pipe through the journal of a revolving bleach, securing it in a fixed position, and allowing the bleach to revolve around it, making the connexion steam tight by packing, in the same manner as the piston rod to a steam engine, by means of a stuffing box and glands, thus avoiding the friction and liability to leakage occasioned by the present method of connecting the pipes by butting the end of the pipe against the end of the journal, which soon insures a leakage by the unequal wearing away of the surfaces in contact."

Claim.—"The manner of introducing the steam to all parts of the revolving bleach at the same moment, by means of a perforated pipe attached to the interior of the bleach, the adjacent ends of which are connected by a socket joint to a stationary induction pipe, arranged so as to allow of the expansion, contraction, and movement of the bleach without derangement."

21. For an *Improvement in Fastenings for Carpets;* William S. Loughborough, Rochester, New York.

Claim.—"Securing the edge of the carpet by means of a button fixed to the floor and turning upon an inclined axis, so as to be self-clamping."

22. For an *Improvement in Hydro-Carbon Vapor Apparatus;* Samuel F. McDougall, Brooklyn, New York.

Claim.—"The double gas pipe for conveying hot air or steam around the pipes to prevent condensing, or any other substantially the same, and which will produce the intended effect."

23. For an *Improved Brace for Supporting Garments;* Daniel Minthorn, City of N. Y.

Claim.—"The arrangement of straps, forming a suspender for the use of ladies or gentlemen, by which the hips are relieved of the weight of the lower garments, which are sustained by the shoulder straps, at the same time leaving the regions of the lower ribs and viscera perfectly free in their action. Also, in combination with the above suspender, the short corset, by which the weight of the skirts is employed to raise and adjust the breasts, and by tightening or loosening which, the said weight is more or less transferred from the shoulders to the breast. Also, the straps attached to the boot or stockings."

24. For an *Improvement in Wagon Wheels;* Sylvanus Perkins, Pittsburgh, Pa.

"The nature of the invention consists in making wagon wheels by combining and arranging a male and female hub, each armed with spokes, the female hub being movable, the spokes in the female hub to arch or dish towards the point of the male hub, and the spokes of the male hub to arch or dish towards its larger end."

Claim.—"The combination and arrangement of the male and female hubs, the spokes, the rib, the tire, the box, and the nuts."

25. For an *Improvement in the Manufacture of Hats;* Andrew Rankin, Newark, N. J.

Claim.—"The employment of the rider for controlling the action of the hands, and, in combination therewith, the upright lever with movable fulcrum for operating the same. Also, uniting the hand and cradle by cords, whereby the hats are readily raised out of water to be handled, and the cradle is held in place to receive a new set of rollers."

26. For an *Improved Portfolio;* Samuel J. H. Smith, Boston, Massachusetts.

Claim.—"Combining a bill or paper file composed of two straight bars or plates and elastic bands united together at their ends, when such bars or plates are so arranged that one may be parallel and above the other, with two covers and a flexible elastic or extension back, so as to constitute the file portfolio, for the retention and preservation of papers or letters, and protecting the mass or file of them on both sides and the back of the same."

27. For an *Improved Furnace for Warming Buildings;* George S. G. Spence, Boston, Massachusetts.

Claim.—"So arranging and combining the exit tube within the reverberating dome and smoke chamber, and with respect to the fire place thereof, that the smoke and gases reverberated from the dome, may not only pass towards the exit tube in convergent streams, but be deflected towards and against the fuel or flame thereof before they may escape into the lower end or mouth of the tube; my improvement being productive of a more perfect combination of the said volatile products than takes place when the exit tube is surrounded by another tube or case, which separates the descending gaseous currents from the fire before they escape into such tube. Also, so combining the valve and discharge tube, that the tube may be movable with the valve and pass through the valve opening, the valve thus serving to support the tube, and rendering unnecessary any arms or such like devices which would tend to collect soot and otherwise obstruct the draft through the valve opening."

29. For a *Bench Rest;* Joseph D. Spiller, Concord, New Hampshire.

Claim.—"Combining with a bench rest, mechanism, for not only elevating said rest with an intermittent rotary motion during successive pressure on a spring thumb slide applied to said bench rest, but for enabling said bench rest to be moved downward whenever necessary. Also, combining with the serrated top plate of the bench rest a plain slide plate."

29. For an *Improvement in Machines for Kneading Clay;* Harlow H. Thayer, Sandwich, Massachusetts.

Claim.—"The employment of the inverted conical chamber provided with a screw or perforated plate, which has its apertures of taper form, said chamber having a plunger working in its upper cylindrical portion. Also, the press chamber in combination with the reciprocating fork for cutting off the clay discharged from the press chamber."

30. For an *Improvement in the Manufacture of Ornamental Felt Cloth;* O. B. Tomlinson, Athens, Pennsylvania.

Claim.—"The manufacture of ornamental felt fabrics by placing colored wool, fur, or any other shrinking substance upon the surface of a sheet of batting, and shrinking the same colored wool, &c., into the body of the felt, to form an ornamental felt fabric."

31. For an *Improvement in Steam Engine Regulators;* Henry Webster, Beetown, Wis.

"The nature of the invention consists of a float placed within a vessel which is kept constantly supplied with water by a small pump or pumps driven by the engine, and which is provided with a suitable aperture from which there is a constant escape regulated by a valve. The float is connected with a throttle valve cut-off. When the engine continues to run at the desired velocity, the water escapes from the vessel as fast as it is pumped in, but if the speed of the engine increases, the water is pumped in faster than it can escape, and the float rises, and by its action on the throttle or cut-off causes the supply of steam to be diminished, or, if necessary, stopped altogether; and if the speed of the engine diminishes, the level of the water in the vessel falls and with it the float, thus acting on the throttle or cut-off to increase the supply of steam."

Claim.—"Controlling the escape of the water by the flap valve and the rod with its inclined piece."

32. For an *Improvement in Gas Regulators;* Hiram Wheelock, Boston, Mass.

Claim.—"The use of textile or fibrous substances for packing the chamber of a gas regulator."

33. For an *Improved Melodeon;* Wm. C. Whipple and Wm. C. Bowe, Westville, Conn.

Claim.—"The use of two sets of levers located in the wind chest under the valves, and so connected as to enable us to play any desired tune and its octave."

34. For *Improvements in Looms;* Wm. Whiteside and John Shinn, Philadelphia, Pa.

Claim.—"1st, The combination and arrangement of one lever at the bottom of the loom with one at the top, in such a manner as to control any number of levers of harness that may be desirable, and open the warp-shed evenly both ways. 2d, The combination of the guides, traveling rods, the rollers, and straps connecting the levers, for the purpose of bringing the hooks to their proper place in time to be ready for the next movement of the pattern roller. 3d, The vertical levers in combination with the wires for the purpose of actuating the hooks. 4th, The combination of the swinging plates with the levers, or the equivalent arrangement of the same, for the purpose of actuating the pickers. 5th, The rod G, or its equivalent, so arranged with the rod I, that when the shuttle is arrested in front of the reed, it will cause the protecting finger to strike the lever and shift the driving strap and immediately arrest the further advance of the lay. 6th, The following as an improvement on the machine of E. Burt, dated June 20, 1845, in which the said E. Burt claims the hanging weft protector on the race of the lay itself. The balance catch in combination with the loop and operated by the swell, so that when the weft thread is broken or exhausted, it will immediately arrest the motion of the loom in the first forward motion of the lay."

35. For *Improvements in Boot Crimping Machines;* George W. Zeigler, Tiffin, Ohio.

"The nature of the invention consists in so constructing and arranging the devices which operate the crimping iron as to carry it in between the jaws with a compound motion. Also, in corrugating the jaws, so as to work the leather away from the angle of the crimping iron and into the foot and leg of the boot."

Claim.—"1st, The segment, gear, and rack, or their equivalents, in combination with the slots, or their equivalents, for the purpose of giving to the plate the motion. 2d, Corrugating the jaws of boot crimping machines, (as in the nature of the invention)."

36. For an *Improvement in Ring Spinning Frames;* Wm. Darker, Jr., Assignor to J. B. Thompson, Philadelphia, Pennsylvania.

Claim.—"1st, The method of applying the rings to enable them to receive rotary motion, that is to say, attaching them to the top of metal sockets, which are large enough to receive the bobbins, and are secured to tubes, which revolve easily upon the spindles. 2d, The method of attaching the bobbin to the spindle by a ball which drops in a slot at the top of the spindle, whereby the bobbin is properly secured, and the tube is allowed to be of proper length to steady the ring without interfering with the bobbin."

37. For an *Improvement in Wrought Iron Beams and Girders;* Anthony Pollak, Philadelphia, Pennsylvania.

Claim.—"The combination in wrought or malleable iron beams or girders of top and bottom T pieces, with flat or plane surfaced longitudinal plates riveted upon both sides of the stems or vertical portions thereof."

JUNE 12.

38. For a *Filter;* Thos. C. Clarke, Camden, New Jersey.

Claim.—"The application of the spring, so that it shall, in connexion with the pressure of the incoming stream of water, work the upper and lower valves, always leaving the lower valve open for the passage of sediment after the running of the water ceases, thus forming a self-cleansing filter, which cleansing is further promoted by the facility with which the filtering medium itself is changed and renewed by unscrewing the lid in which the filtering medium is secured."

39. For a *Hydrant Filter;* Thos. C. Clarke, Camden, New Jersey.

Claim.—"The combination of the filtering chamber, the rod and the valves, whereby the simple operation of starting the water brings into operation the filter, and the stopping off the water opens the escape for the sediment."

40. For a *Feed Motion for Saw Mills, &c.;* Chas. M. Day, City of New York.

Claim.—"The clamps attached to a lever and working upon a pulley, in combination with the rack and pinion attached to the arm. Also, the levers attached to the pivots of the clamps and connected by the pin and slot at their inner ends, for the purpose of relieving the clamps from the pulley when the carriage is gigged back."

41. For an *Improvement in Mill Bushes;* George L. Dulany, Mount Jackson, Va.

Claim.—"The wedge cheeks, movable disk, and self-acting wedge, or their equivalents."

42. For an *Improvement in Buoys for Raising Sunken Vessels;* Elisha Fitzgerald, City of New York.

Claim.—"The attachment to the air bag of an escape valve to prevent its bursting, when, in consequence of the rising of the sunken ship, the pressure of the water around the bag is partially relieved."

43. For an *Improvement in Supplying Furnaces with Hot Air;* Calvin Fletcher, Cincinnati, Ohio.

Claim.—"The arrangement of the fan steam tubes, together with the inlet passages for steam and cold air, and the discharge of hot air and water of condensation."

44. For an *Improvement in Window Sashes;* Wm. S. Ford, City of New York.

Claim.—"Constructing folding, hinged, or French windows, so that the hinged sashes may be raised and lowered the same as the ordinary sliding sashes, and, also, be allowed to swing as French sashes, whereby said sashes are kept closed without the application of any special fastening, and also rendered perfectly weather proof."

45. For an *Improvement in Fastening Scythes to Snaths;* William P. Greenleaf, Washington, New Hampshire.

Claim.—"The mode of fastening scythes to snaths by the employment of the ferrule at the end of the snath, the bolt, the nut, the notch in the shank of the scythe, the toe or claw of the scythe, and the perforated plate."

46. For an *Improvement in Bedsteads;* Florian Hesz, Cincinnati, Ohio.

Claim.—"The four levers attached to the inside of the posts in combination with the diagonal rods and plate connected with the screw, all for the purpose of holding the side and end rails of the bedstead firmly to the posts."

47. For a *Machine for Planing Staves;* M. T. Kennedy, Fallston, Pennsylvania.

Claim.—"The combination of the disk and clamp, the clamp being formed of a series of rods passing through the disks and provided with springs and lips."

48. For a *Machine for Jointing Staves;* M. T. Kennedy, Fallston, Pennsylvania.

Claim.—"The combination of the reciprocating planes and clamp."

49. For an *Improvement in Door Locks;* John C. Kline, Pittsburgh, Pa.

Claim.—"The inclined or oblique faces and notch of the bolt, in connexion with and operated by the key tumbler."

50. For an *Improvement in the Arrangement of Bumpers for Self-Acting Car Brakes;* James J. McComb, New Orleans, La.

Claim.—"Allowing the brake beams of each car to abut against the car or platform of the car next to it, by which means I make available the whole play or distance between the cars in bringing up the brakes, and thus more effectually apply them than heretofore."

51. For an *Improvement in Revolving Fire Arms;* Fredk. Newbury, Albany, N. Y.

Claim.—"The construction and use of a guard to prevent the fragments of exploded priming caps from impeding the rotation of the cylinder by covering up the cones with a movable metallic ring, containing for each cone a chamber as large as can be conveniently made within the ring to enclose each cone; each chamber having an aperture to permit the priming cap to pass through, and, also, having lateral openings to pass off the gas produced by the detonation of the cap."

52. For a *Sawing Machine;* Isaac M. Newcomb, Eden, Vermont.

Claim.—"The bar secured to the arms of the vibrating frame by a hinge joint and its connexion with the saw shaft. Also, the guide arms of the carriage. Also, the lifting arm and catch rod, combined with the hook of the saw shaft, the oblique tongue and notched slide."

53. For an *Improvement in Propellers;* Joseph H. Penny and Thomas B. Rogers, City of New York.

Claim.—"The arrangement of the connecting rods with the connecting heads and the paddles, the connecting rods passing through the connecting heads, and the paddles being bolted to such rods, so that any one or more can be removed, if necessary, without interfering with the others, the whole being strong, and at the same time of light construction."

54. For an *Improvement in Cutting Clay into Bricks;* John Plumbe, San Francisco, California.

Claim.—"The mode of forming bricks, or their equivalent, by means of wires, or the equivalent, cutting upwards, irrespective of the manner in which the clay is prepared and placed in the mould frame."

55. For a *Method of Tuning Accordeons;* Edgar A. Robbins, Rochester, N. Y.

Claim.—"Such mode of tuning the reeds of accordeons and flutinas as will require but four modes or forms of fingering to perform twelve scales, any number of octaves within the compass of the instrument."

56. For an *Improved Stave Machine;* George H. Swan, Bridgeport, Conn.

Claim.—"Chamfering, beveling, and howeling barrels, kegs, &c., in fact, any thing requiring a croze, chamber, howel, or bevel, by means of two levers operated upon by springs and gauging or connecting rod, in such a manner, as to gauge the work, from the outside of the cask being round, or not working exactly to the shape of the head truss hoop, with any kind of croze, knives or saws, necessary to give the desired croze or groove, chamfer, or bevel, howel, and bevel, and the two levers are attached to the slide by pin or bolt acting on one or separate centres, and that slide made fast to the arm of the thumb or set screw at any point from the shaft, or doing away with the slide, and putting the pin or bolt directly through the arm at any point from the shaft required, consequently, adjustable to any size."

57. For an *Improvement in Sheet Metal Folding Machines;* Orson W. Stow, Plantsville, Connecticut.

Claim.—"Effecting the simultaneous action of the two folding bars, by so connecting or driving them, that, upon operation being given to the one folding bar, the other folding bar is set in corresponding action or motion thereby, whereby the folding plate is relieved from unequal and varying strain or pressure on its one side or face, the two "folding bars" are necessitated to act in unison, and the one operative lever serves to set both "folding bars" in motion."

58 For an *Improved Faucet;* Edward A. Sterry, Norwich Town, Connecticut.

Claim.—"The arrangement of the valve, the set screw, the grooved shank, and the screw enlargement of the spindle of the key with each other, and with the female screw in the sides of the chamber, and the groove which cuts through the threads of said screw, by which, in a cock of the usual proportions, the valve can be moved up and down without being turned on its axis."

59. For an *Improved Coupling for Organs and Melodeons;* Henry W. Smith, Boston, Massachusetts.

Claim.—"The combination of the lever with the shoulder on the valve rod."

60. For an *Improved Tenoning Machine;* Christopher Sharps and G. E. Adriance, Hector, New York.

Claim.—"The arrangement and combination of the two planes and cutters for cutting the tenon, rest, for supporting the spoke; drop, for keeping it down upon the rest while the tenon is being cut, and guide-box having a mouth and discharge. Also, the combination and arrangement of the plane stocks with planes arranged, so as to move in and out, slotted springs, to allow for said movements; spring and treadle, for causing said expansion."

61. For an *Improvement in Door Locks;* Joseph C. Silvy, New Orleans, La.

Claim.—"The circular or solid circular bolts, one-half in the lock and the other half in the catch. Also, the extension key, to lengthen or close the tumblers by means of a screw or slide, together with a scale to regulate the sliding bolt or bolts in the lock."

62. For an *Improvement in Guard Rails of Railroads, to be used with Pronged Cow Catchers;* Hosea D. Searles, Rockford, Illinois.

Claim.—"The combination of elevated guard ribs with the track, when the same are so arranged, that the prongs of the cow catcher of the locomotive may run between them."

63. For an *Improvement in Plank Roofs for Buildings;* Samuel Taylor, Petersham, Massachusetts.

Claim.—"Making each of the boards of a saddle form, in order that when laid together, their contiguous plane surfaces may not only be in close contact, whereby they will add greatly to the stability and efficiency of the roof, but be so inclined as to prevent water from remaining between them and causing or promoting their decay. Also, the improvement of providing each of the grooves of the upper boards with an inverted metallic or water tight lining or trough, for the purpose of protecting the joint directly under the same when the board becomes cracked or split."

64. For *Improvements in Heating Wrought Iron Wheels for Forging;* William R. Thompson, Cleveland, Ohio.

Claim—"The method of heating hubs for wrought iron wheels, viz: by a peculiar arranged furnace, which causes the heat to pass around and through the centre of the hub from above and below, alternately, as may be required, and when heated to a sufficient degree, the sections are welded into a solid hub by the compressing and swedging action of dies conforming to the shape of the hub and spokes."

65. For a *Portable Floating Filter;* Nathan Waterman, Boston, Mass.

Claim.—"A portable floating water filter, wherein the water is filtered from the outside into the inside under an uniform pressure, regardless of the quantity of water in the filter."

66. For an *Improved Curvilinear Sawing Machine;* Shelden Warner, Enfield, Mass.

Claim.—"Placing the saws in frames, which are allowed to move laterally in the saw frame or sash, and having said saws so attached to the frames, as to be allowed to turn therein, said saws being turned by means of the rods *k*, *n*, attached to transverse bars on the vertical rods, *f;* the rods, *f*, being turned by the rods *n* and levers, the outer ends of the rods bearing against the pattern and operated as said pattern moves. Also, straining and attaching the saws to the frames by having bows attached to the ends of the saws and screws passing through them, the ends of said screws resting upon the top and bottom strips of the frames."

67. For an *Improvement in Artificial Fuel;* Wm. D. Beaumont, Mobile, Alabama.

Claim.—"The manufacture of a new article of fuel, composed of coal screenings, clay, or marl, fine straw or litter, crude turpentine, and gypsum, or their equivalents."

68. For an *Improvement in Soda Water Generators;* Wm. Gee, City of New York.

Claim.—"The construction of a soda water generator, having the heads connected to the cylinder by a single bolt, which shall also serve as a shaft for the agitator to revolve upon."

69. For an *Improvement in the Buckets of Paddle Wheels;* Augustus M. Glover, Waterborough, South Carolina.

Claim.—"A plane concave to the paddle, that all the advantage of the concave is secured without loss of hold upon the water and slip in backing vessels propelled by wheels."

70. For an *Improved Self-Acting Cotton Press;* Jonathan Grout, Hocking City, O.

Claim.—"The construction of a press, designed for the general purposes of a press, so arranged as to swing freely about an axis of motion, and having a lever or set of levers with their fulcrums within the said axis of motion, so that when the press is swung out in one direction, the said levers are brought into such a position, relative to the other

parts, that they take hold of the beam and thrust it down as the press is swung back to its former position, and in a manner which allows the operation to be repeated until the degree of pressure desired is attained."

71. For an *Improvement in Pressing Tobacco in Plugs;* George King, Farmville, Va.

Claim.—"I claim the box and plunger, when arranged and operated, so that both the box and plunger have a reciprocating motion, for the purpose of allowing the tobacco to be fed into the box, and also compressed therein. Also, the combination of the box and plunger with the hopper and slide."

72. For an *Improvement in Wheat Fans;* Joseph Montgomery, Lancaster, Pa., and James Montgomery, Baltimore, Maryland.

Claim.—"Constructing the screw box with the addition of a plate or apron under its upper screw, for conveying whatever passes through said screen to the front part of the box, and of a fine screen at the bottom for separating sand or grit from the small grain and seeds caught therein, in combination with a box, or its equivalent, beneath, for collecting or conveying away the sand or grit thereby separated. Also, adding an adjustable board or shelf in the front part of the shoe, so situated, that light and bulky impurities blown from the apron may be caught thereon and conveyed out of the shoe, whilst sufficient space is left behind and below it for the whole extent of screw beneath to be employed to receive the grain."

73. For an *Improved Machine for Cutting the Edges of Boot and Shoe Soles;* Jean Pierre Molliere, Lyons, France; patented in France, January 5th, 1855.

Claim.—"Cutting down or paring and sawing of the edges of the soles and heels of boots and shoes, by means of the circular tools revolving upon horizontal, vertical, or angular axes."

74. For an *Improvement in Sewing Machines;* T. J. W. Robertson, City of N. Y.

Claim.—"Making a needle thread single or chain stitch, by means of a detached and loosely held looper and reciprocating needle, arranged and operating together in such a manner, that while the needle in its back stroke draws the slack of its thread on to, or along and around the looper, the looper without detaining the loop formed by the drawing of the slack of the needle thread on and along it, guides and keeps the loops open, and the needle and its thread in their next advance stroke pass through the open loop, which, kept moving and having the further feed of its own, or needle thread passed through it, is drawn entirely over and off the looper to complete the stitch."

75. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"Feeding the cloth or other sabstance in sewing machines by means of a wheel hung on a vibrating lever, or equivalent thereof, and borne upward by a spring, or its equivalent, against the under surface of and in combination with a fixed pad above."

76. For an *Improved Wind-Mill;* Chas. R Webb, Philadelphia, Pa.

Claim.—"Placing the two cog wheels in the head of the mill, so that they shall gear into each other in centre thereof, and bringing down the power from said wheels by an oblique shaft, whose foot or bearing is vertically beneath the teeth in contact in the head of the mill."

77. For an *Improved Serpentine Spinner to Catch Fish;* Chas. DeSaxe, Assignor to Thos. H. Bate, City of New York.

Claim.—"A spinner constructed of a piece of metal twisted or coiled upon its edge, and then attached to and winding about a hook or other piece of tackle."

78. For an *Improvement in Printing Presses;* Joel G. Northrup, Assignor to James D. Mather, Syracuse, New York.

Claim.—"The manner of giving motion to the bed of a printing press, viz: by means of a vibrating connecting rod, one end of which is attached by a stud pin or wrist to a stand that projects from the lower side of the bed, the other end being connected by a similar wrist to an endless chain which passes around two wheels which revolve, thus producing an elongated crank motion. Also, the manner of attaching, combining, and communicating its motion to the bed."

79. For a *Metallic Medium for Filtering;* Orson C. Phelps, Assignor to self and John Holton, Boston, Mass.

Claim.—"The use of disks of rolled wire gauze prepared and applied to the filter."

80. For a *Machine for Ruling Leather;* Joshua Turner, Jr., Charlestown, Assignor to Asa Bennet, Boston, and Warren Covell, Dedham, Mass.

Claim.—"The improved manner of combining each of the striping wheels of the machine with its movable bed and inking or coloring roller, the same consisting in applying said striping wheel to its shaft, in such manner as to enable it to rotate on the same and to play freely thereon in any direction in a plane perpendicularly thereto, and to such extent as to accommodate itself to the changes in the surface of the leather, or article to be striped, and, at the same time, keep in close contact with its coloring roller or cylinder. Also, combining with the series of striping wheels arranged together and on a shaft, a mechanism for raising and maintaining either one or more of them out of action with the surface to be striped and the coloring roller during the movement of the remainder of such wheels and the bed and surface to be striped under them, such mechanism being a cross bar or frame and its set of suspension hooks. Also, combining with the series of striping wheels and the bed, a mechanism, not only for raising said wheels from a skin resting on the bed, and after it has been striped by them, but for maintaining them entirely off the skin during the backward movement of it and the bed, the said mechanism being a rocker arm, with its weight, the catch or latch, the lifter, and the projection as applied to either one or both ends of the shaft. Also, combining with a series of striping wheels a spout or receiver, and peripheral and side or edge scrapers operating with respect to the spout and wheels."

81. For an *Improvement in Machines for Cutting out Boot and Shoe Soles;* Caleb H. Griffin, Assignor to self and Geo. W. Otis, Lynn, Mass.

Claim.—"The combination of the depresser bar with the reciprocating knife frame, its two movable knives and their elevating springs, or equivalent machinery, arranged and made to operate together. Also, the combination of mechanism for imparting to the knife frame its intermittent reciprocating movements, the said combination consisting of the two momentum levers, the barrel on the driving shaft, and the two sets of connecting straps, the same being applied to the carriage and shaft."

82. For an *Improvement in Attaching Gutta Percha Soles to Boots and Shoes;* John M. Wimley, Assignor to J. A. B. Shaw, Philadelphia, Pa.

Claim.—"Manufacturing or making boots and shoes with the outer soles made entirely of gutta percha, when the said outer soles are simultaneously formed and united to the 'upper' and 'insole' by means of heat and pressure in a mould."

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83. For an *Improvement in Stone Sawing Machines;* Joseph Adams, Fairhaven, Vt.

Claim.—"The application to the saw frame, hanging from cords, so as to move, of necessity, in the arc of a circle, of the counterbalancing weight, which at the same time permits it to feed itself at all parts of its motion."

84. For an *Improvement in two Motion Cone Valves;* Horatio Allen, City of N. Y.

Claim.—"So constructing a cone valve that in the operations of opening and closing the same, two motions shall be imparted to it, in or nearly in succession, and in directions at a right angle with each other; the first of said motions effecting the withdrawal of said valve out of contact with its seat, and retaining it so withdrawn, while the second motion shall be given, whereby it can, by that second motion, be turned without friction against the seat."

85. For an *Improved Machine for Cutting Irregular Forms;* Avery Babbett, Auburn, New York.

"By this machine a great variety of angular irregular forms may be produced, by simply changing the form of the cutters or knives and varying the setting of the indices."

Claim.—"The machine for the purpose of producing angular irregular forms."

86. For an *Improvement in Corn Planters;* Uriah Beebe, Oakland, Michigan.

"The nature of this invention consists in a new and improved mode of planting in check rows, by means of shafts and supports attached to the planters, which act as levers

to raise the wheels to enable the driver while seated to adjust the planters, and which also act as covers to complete the process of planting."

Claim.—"The shafts and supports."

87. For an *Improved Reciprocating Railway Propeller;* Henry Boynton, Hinesburgh, Vermont.

Claim.—"1st, The double wheeled oar truck, provided with wheels rotating in opposite directions on the same axis and running between upper and under simultaneous acting railways, by which a longitudinal propeller for water craft is held or confined to its designed railways. 2d, In combination with two sets of railways, one for the forward and the other for the back stroke, the ascending and descending railways, so arranged that the fore wheels of the truck run upon one track and the after wheels upon another track, whereby the truck is free to ascend and descend at either end of the main railways in such a manner that a line drawn through its axles will be always parallel, or nearly so, to the main horizontal rails. 3d, The lower rising vibrating rails and the upper pivot moving rails. 4th, The combination of levers in their adaptation to railway propellers, by which the upper pivot rails at either end of the railways being moved by the truck wheels, those at the opposite end are similarly moved at the same time, and the addition of safety levers, by which if the pivot rails upon either side end are moved, all the others are similarly moved at the same time. 5th, The combination of levers, by which the catch bars or fastenings to the upper pivot rails are governed and disengaged by the truck wheels, and by which, if either one is disengaged, the others are also at the same time. Also, the combination of the curved toe rocking shaft, with the oscillating riding bar, sustaining a weight or spring with any reciprocating arm attached to the engine, for the purpose of gradually and rapidly retarding the piston and bringing it and the oar truck to a state of rest."

88. For an *Improvement in Railroad Car Seats;* John H. Cocke, Bremo, Va.

Claim.—"A back constructed with a rigid arm, the guide pins of which turn in a curved slot provided with a catch, while the back hinges upon the support for its lower edge. Also, in combination with a reclining reversable back, a concave seat, so that persons occupying the seat will not be liable to slide off as they would if the seat were flat or convex."

89. For an *Improvement in Apparatus for Replacing Railroad Cars upon the Track;* S. Park Coon, Milwaukie, Wisconsin.

Claim.—"The construction of a windlass, pulley, chain or rope, and foot stocks, in such manner as to adapt and attach them to a section or length of railroad rail, to form an apparatus that can be used for replacing railroad cars upon the track, and when this duty is done, the parts of which can easily be separated for more convenient transportation, and packed in the tool box of the tender or other appropriate receptacle."

90. For an *Improved Fish Hook;* Richard F. Cook, Troy, Alabama.

Claim.—"The combination and arrangement of the steel strips having baits formed on them, collar, or plate, rod, spiral spring, ring and bait hook."

91. For an *Improvement in Ploughs;* L. G. Evans, Spring Hill, Alabama.

Claim.—"Connecting and arranging the mould beam, land side, and cutter, in such a manner that they are together capable of a vertical and lateral adjustment in addition to the particular adjustment of the mould beam."

92. For an *Improved Coal Screen;* James P. Fennel, Philadelphia, Pennsylvania.

Claim.—"A portable coal screen composed of a tight box, within which are arranged a rotating screen and two drawers, the openings into which box, are provided with doors, so that the box shall remain tight when either or both the drawers are taken out."

93. For an *Improved Machine for Cutting the inside Hold of Shovel Handles;* George Fetter and Joseph L. Pennock, Holmesburg, Pa.

Claim.—"Cutting the inside hole of D shaped handles for shovels, spades, etc. by means of a curved cutter, so operated as to pass one half way round one end of the hold, the cutter smoothing or rounding a portion of said hold equal to its width, and then remaining stationary, while the handle is moved to force the remaining uncut portion of the hold past the cutter. Also, operating the cutter by means of the cam, frame, geared

sector, and half cylinder, to which the cutter is attached. Also, operating the carriage to which the handle is attached by means of the cam and racks."

94. For an *Improvement in Springs for Hinges, &c.;* Arasmus French, Waterbury, Connecticut.

Claim.—"The method of composing a spring of a series of elastic rods, connected at each end to plates, or their equivalents, and at or nearly at equal distances from the centre of the plates, and surrounded at or nearly at the middle of their length, by a collar or ring, so that they shall be held nearer together at the middle than at the ends."

95. For an *Improvement in Scaffolds;* Abram C. Funston, Philadelphia, Pa.

Claim.—"Making the back upright of one or all of the sections or frames forming this particular scaffold in two parts, and providing the lower part with a slot, and uniting it to the upper part by a set screw which plays in the slot and allows of the lower part being raised."

96. For an *Improved Expanding Block for Horse Collars;* Robert R. Gray, Crawfordsville, Indiana.

Claim.—"The arrangement of the two sets of jaws, by which the inner jaws alone are actuated directly by the screw, while the outer jaws are actuated by the expansion of the inner, and the pressure of the springs, both jaws being guided by the slots."

97. For an *Improved Stump Machine;* Stephen Gordon and Francis Morris, Crawford County, Pennsylvania.

Claim.—"The construction of the machine, to wit: with a main shaft and wheels, with the larger wheel fastened on to the shaft, and the lesser wheel constructed so as to turn on the shaft."

98. For an *Improved Mode of Hanging Bells;* George W. Hildreth, Lockport, N. Y.

Claim.—"The round tapering shank and corresponding hole in the yoke, in combination with the bolt and cap to secure the bell firm into the yoke. Also, the doweling of the cap to the yoke, and the manner of securing the bolt from turning in the cap."

99. For an *Improvement in Doors;* Orvis C. Hill, Malone, New York.

Claim.—"Inserting springs and strips into grooves in the beveled top, bottom, or outer edge of a door, where the said door is made to fit into a casing, which is correspondingly beveled, by which the joints of the door are made wind and water proof."

100. For an *Improved Piano Forte Action;* Robert M. Kerrison, Philadelphia, Pa.

Claim.—"Solely the means I employ to check and hold the hammer after the blow; and as part of those means, the impeller. Also, the hammer butt, of a form suitable and proper to receive the action or pressure of two parts or branches of the impeller at two different points. Also, the impeller and the hammer butt, or their equivalents, acting conjointly as a means of checking and holding the hammer after a blow."

101. For an *Improved Hot Air Furnace;* John L. Kite, Philadelphia, Pennsylvania.

Claim.—"The combination of the castings with their vanes, and with the outside casing, for obtaining a great amount of heating surface at the expense of a small quantity of fuel."

102. For an *Apparatus for taking Stereoscopic Photographs;* Joseph H. Marston, Philadelphia, Pennsylvania.

Claim.—"The particular arrangement of two frames, or guides or boards, that shall work on and be fastened or pivoted on the camera board at the centre and front of the camera board, the frames or guides to be at right angles, so that when closed together they form the raised ledge parallel with each other by which to adjust and centre the angle board previous to setting the angles for stereoscoping. Also, the application of the spring to hold the frames together, the right and left screws and nuts and eye plates to force apart, and hold the frame in any desired angle. The above described apparatus is claimed, for moving the camera box and giving the true stereoscopic angle at one and the same time."

103. For an *Improvement in Fastenings for Carpets;* Felix Miller, City of N. York.

Claim.—"The method of laying and securing carpets down upon floors by means and use of the claw hook operating and combining with the carpet and eyelet on the floor."

104. For an *Improved Machine for Cutting Leather into Strips for Boot and Shoe Soles and Heels;* Jean Pierre Molliere, Lyons, France.

Claim.—"The cutting up of the sides of leather into sole or heel strips of any required breadth, by means of the self-arresting curved knife blade driven alternately to the right and to the left, by the Vaucanson chain, while the leather is held in its place against the adjustable pins by the spring ruler."

105. For an *Improved Method for Securing Cutters to Rotary Disks;* Jonah Newton, City of New York.

Claim.—"Securing the cutters to the disk or plate, viz: having the cutters of semi-circular form, with ledges or projections on their back or convex sides, the ledges or projections being fitted in grooves in the semi-circular edges of the projections of the plate, the front or concave sides of the cutters having grooves in them to receive the nuts or segment heads, the projections, cutters, and nuts or heads, having screws passing through them for the purpose of allowing the cutters to be adjusted properly, and also securing firmly the cutters to the disk or plate."

106. For an *Improved Machine for Cutting Locks and Tapering ends of Wooden Hoops;* Royal Parce, Pitcher, New York.

Claim.—"The principle of cutting locks in wooden hoops by means of knives, or other cutting apparatus, having substantially the form of the lock required to be made, and cutting both transversely and longitudinally by the same movement."

107. For an *Improved Ice House;* W. D. Parker, City of New York.

Claim.—"The construction of the ice house, viz: having the ice house formed with double sides and double roof, with a suitable non-conducting substance packed between them, the house being provided with a slatted floor having an ice chamber underneath it, and also provided with a double inclined floor at its upper part, underneath which a screw is secured, on which charcoal and other absorbents are placed; a flooring, *l*, being placed on the flooring, *i*, and having holes or traps provided with doors made through it and also through the flooring *i*, also containing ice."

108. For an *Improved Machine for Manufacturing Wooden Ware;* David Pierce, Woodstock, Vermont.

Claim.—"The application and use of a cutter, or cutters in gangs, attached to a sliding rest, or their equivalent. Also, the apparatus for forming and finishing circular or elliptical heads or bottoms. Also, the apparatus for turning out the inside of the cylinders and cutting the croze."

109. For an *Improved Fan Blower;* David Pollock and J. R. Pollock, Lancaster, Pa.

Claim.—"Making the shaft hollow with open ends and with apertures in the sides within the blower casing, for the purpose of inducing a current of air through the shaft to keep it cool and at the same time to increase the supply to the fan. Also, making the pulley which receives the driving belt, hollow, with closed ends and a perforated face, and providing openings from its interior into the shaft, for the purpose of causing the displacement of the air between the belt and the face of the pulley, and at the same time increasing the supply to the fan."

110. For *Socket Handles for Chisels;* Lovell T. Richardson, Worcester, Mass.

Claim.—"Constructing the sockets with a die so formed that a transverse partition or ledge is left within the socket, said partition or ledge dividing the recess which receives the shank, so as to obtain a sufficient body or weight of metal at that part of the socket which is welded to the shank of the tool or implement, for the purpose of forming a strong and durable connexion of the socket and shank."

111. For an *Improvement in Producing Intermittent Acceleration of Motion in Harvester, Rakes, &c.;* John Richardson, Buckeystown, Maryland.

Claim.—"A device for producing an accelerated motion whether in rakes or for other purposes, said device consisting of the cam on the drum, and the ratch and pawl, and friction wheel."

112. For an *Improvement in Grain Cleaners;* Harrison D. Reynolds, Pendleton Ind.

Claim.—"The openings, in combination with the conductor and scouring cylinder."

113. For an *Improved Chuck for Turning Eccentrics;* John W. Russell, Springfield, Massachusetts.

Claim.—"The application of a chuck to irregular objects and points eccentric from the centre, using for that purpose the jaws and the screw in combination with the nuts or collars."

114. For an *Improvement in Seed Drills;* James Selby, Lancaster, Ohio.

Claim.—"Distributing the seed by means of the transverse slides, in combination with the reciprocating slides, operated by means of an adjustable crank formed by the sliding bar."

115. For an *Improved Apparatus for Moving Stereoscopic Pictures;* Albert S. Southworth and Josiah J. Hawes, Boston, Massachusetts.

Claim.—"Giving to the pictures of a stereoscope or other analogous instrument, a panoramic motion into and out of the fields of vision by means of mechanism, or by any other means equivalent thereto."

116. For an *Improvement in Rotary Engines;* Sylvester Stevens, Boston, Mass.

"The nature of this invention consists in dividing the cylinder into two separate and distinct chambers or cylinders, which are separated from each other by a revolving disk, to which are attached the two pistons, one for each cylinder. These two pistons, in lieu of being placed opposite each other, are set a short distance apart, so as not to receive their steam at the same instant, whereby the single disk, with its two pistons, is enabled to pass the dead centre as surely as where two cylinders with cranks set quartering are employed."

Claim.—"The revolving disk with its valves."

117. For an *Improved Self-Acting Brake for Vehicles;* Peter Ten Eyck, City of N. Y.

Claim.—"The employment of the shoes, attached to the back axle of the vehicle by the jointed arms or levers, where said shoes are connected to a sliding draft pole by rods and chain, said pole having a spring attached to it."

118. For an *Improved Self-Operating Circular Gate;* William Thompson, Nashville, Tennessee.

Claim.—"Constructing the gate of circular form, and having said gate rest upon a vibrating rail, which is connected to a platform or arranged in any proper way, so that said rail may be inclined either by the weight of the person, vehicle, or animal which is to pass through it, or by any other device, and cause the gate to roll down the depressed end of the rail, and consequently leave a free or open space between the posts, said gate closing or returning to its original position between the posts when the rail is relieved of the weight or pressure which first actuated it."

119. For an *Improved Brick;* Levi Till, Sandusky, Ohio.

Claim.—"The making of bricks with channels or grooves, and with spurs or conical projections."

120. For an *Improvement in Steam Boilers;* Charles F. Thomas, Taunton, Mass.

Claim.—"The improvement of extending the tube sheet, smoke tubes, and boiler, or its enclosing sheet, into the fire place and over the fire grate, in order not only that the part so extended may serve as a beam or strut to support the sheet against the superincumbent pressure of the steam, but that the flame and gases from the fire may not only pass against the tube sheet and enclosing sheet of the extended part of the boiler, but also through the extended parts of the tubes within such projected part of the boiler as specified, the same serving to greatly increase the extent of heating surface exposed to the fire."

121. For an *Improvement in Hose Couplings;* Albert M. Waterhouse, City of N. Y.

Claim.—"The slotted nut with the female screw on its inner surface. Also, the pipe with straight or vertical slots (one or more) and with a screw on its outer surface. Also, the combination of these parts, or their equivalents, each with the other, and all together, and all other combinations substantially the same."

122. For an *Improvement in Joints for Stove Pipes;* Alva Wordon, Ypsilanti, Mich.

Claim.—"The inclined tapering semi-circular grooves."

123. For an *Improvement in Joints of Pipes for Artesian Wells;* Jesse Norris Bolles, Philadelphia, Pennsylvania, Assignor to H. J. Ockerhausen, Baltimore, Md.

Claim.—"The mode of rendering cylinders or tubes flush, or upon a line on their exterior surfaces for artesian wells, or for other purposes, or any other mode substantially the same which will produce the same effect."

124. For an *Improved Mill Dress;* George L. Dulaney, Mount Jackson, Assignor to Reuben Allen, Shenandoah Co., Virginia.

Claim —"The construction of a compound elbow mill dress, formed by the divisional mode of calculation, having main elbow leads, gutters, or grooves, formed with secondary or branch elbow leads or conveys, communicating directly therewith instead of being a distinct or separated series; the said compound elbow dress being formed upon the face of a mill stone having an inward sloping or depressed surface, together with an outward sloping feed or supply circle."

125. For an *Improvement in the Manufacture of Artificial Stone;* Thomas Hodgson, Brooklyn, New York, Assignor to Robert L. Wright, City of New York; patented in England, May 9, 1854.

Claim.—"The composition formed by the admixture of sand or pulverized stone, plaster of paris, and beasts' blood, when these ingredients are mixed in the manner, and in about (without limiting myself precisely to) the proportions to be moulded or cast, while in a plastic state, into blocks, architectural ornaments or devices, statuary, or ornamental or other forms or figures, and in such conditions used as a substitute for stone, for building, architectural, or other ornamental purposes."

126. For an *Improvement in Machines for Boring Cylinders;* Marvin S. Otis, Assignor to Charles Rumley, Rochester, New York.

Claim.—"The arrangements of the parts so as to produce an alternating transverse motion of the cylinder, in combination with a rotating movement of the cutter, or vice versa."

127. For an *Improvement in Making Nuts;* Isaac H. Steer, Winchester, Va., Assignor to Henry Carter, Pittsburgh, Pa.; ante-dated December 19, 1854.

Claim.—"1st, Making a nut at a single operation from a heated bar or plate of metal by cutting off the blank from the bar, punching a hole or eye through it, and swaging it into shape. 2d, Punching the eye of the nut in a die or press box, by which it is surrounded and firmly supported, and thus prevented from straining or bursting during the operation. 3d, Shaping nuts by subjecting them while hot to powerful and sudden compression on the punch, and in the punching die, whereby they are finished with such a degree of smoothness, regularity and precision, that in the condition in which they come from the machine they are fit to use in the construction of most kinds of machinery, and are at the same time sounder and stronger than unpressed nuts made by machinery."

JUNE 26.

128. For an *Improvement in Bridle Winkers;* Wm. Boyd and Wm. F. Boyd, Watertown, Massachusetts.

Claim.—"Forming the flaring or projecting portions of the winkers of horse bridles on metallic plates."

129. For an *Improved Wrench;* Charles B. Bristol, Naugatuck, Conn.

"The nature of the invention consists in constructing the wrench with a revolving set of spaces to receive the nut, making as great a variety of sizes as the size and strength of the disk will admit of, or as may be desired, and so that the appropriate size may be used in any desired position."

Claim.—"The combination of the disk with the stock and binding pin."

130. For an *Improvement in Weather Strips for Doors;* Martin Croke, City of N. Y.

Claim.—"Placing or securing a strip or strips of india rubber within a bar, which bar is fitted within a recess in the lower end or edge of the door, the bar being rendered adjustable by the set screws."

131. For an *Improvement in Corn Shellers;* Abram Clow and Charles N. Clow, Port Byron, New York.

Claim.—"The tube in combination with the screw on the shaft, for discharging the cobs separately from the shelled corn."

132. For an *Improvement in Brick and Tile Machines;* Henry Clayton, Dorset Square, England; patented in England, December 13, 1852.

Claim.—"Combining with the wires their sliding scrapers or cleansing mechanism. Also, the combination of the accelerating roller and the tilting board with the delivery rollers, or their equivalent."

133. For an *Improved Mode of Hanging Window Sashes;* Daniel N. Dunzack, Salem, Massachusetts.

Claim.—"Attaching the cords to the lower ends of both sashes, and having said cords pass through pulleys, *b*, attached to the weights, the cord at each side of the frame or casing being attached to both sashes, said cords passing over pulleys, *d*, at the centre of the frame or casing."

134. For an *Improvement in Ice Pitchers;* Samuel Eakins, Philadelphia, Pa.

Claim.—"The arrangement of spout, lid, arm, and weight."

135. For a *Tidal Alarm Apparatus;* Moore Russell Fletcher, late of Concord, N. H.

Claim.—"The improvement by which the bell is sounded both at rise and fall of the tide, meaning the two tripping cams applied to each hammer, in combination with the float and weight as applied to the barrel, and made to put in revolution the said barrel, and thereby cause the tappet cylinder to actuate the hammers either during the rise or fall of the tide."

136. For *Carpenters' Mitre and Bevel Square;* Jonas S. Halsted and Cornelius J. Ackerman, City of New York.

Claim.—"Having a ledge or flanch project, one each side of the inner edge of the handle, the upper and lower ends of said handle being cut or beveled at an angle of 45°. The handle being provided with a blade, which is attached at right angles to it, and also provided with an adjustable blade."

137. For a *Balance Valve;* Charles S. Harris, Holyoke, Massachusetts.

Claim.—"The combination of two valve surfaces acting on the two feather edged valve seats, one inside and the other outside the casing or box, in such a manner, that the pressure in one direction on one, is compensated by an equal pressure in an opposite direction on the other, so that the valve will remain in a state of rest without being affected by any pressure, whether on the inside or outside of the casing or box."

138. For an *Improvement in Brick Machines;* A. V. Hough, Green Castle, Ind.

Claim.—"The slides placed at the bottom of a pug mill for the purpose of enabling the operator to regulate the rapidity of the egress of the clay, according as it requires to be subjected to the operation of the cylinder for a longer or shorter time. Also, placing the shaft with its blades in a horizontal position within the cylindrical case, whereby the machine is rendered extremely simple, the journals kept free from clay, and all the parts of the machine operated by the rotation of a single shaft."

139. For an *Improvement in Gas Burners;* Chas. H. Johnson, Boston, Mass.

Claim.—"Combining the gas distributer and purifier with the burner, so as to operate therewith."

140. For an *Improvement in Cotton Gins;* R. A. L. McCurdy, Sabine Parish, La.

Claim.—"The cylinder screen for the reception of the boll, hulls, &c., and the continued spiral flanched shaft arranged inside of said cylinder screen, for the purpose of working out said boll, hulls, &c., or substantially the same, and that will produce the intended effect."

141. For an *Improvement in Horse Collar Blocks;* Peter Moody, Indianapolis, Ind.

Claim.—"The combination and arrangement of the hinge, the slides, levers, and regulators, or severally the equivalents thereof, so as to secure the stretching, stuffing, and blocking of a horse collar of leather, cloth, india rubber, or other material, without removal from the block."

142. For an *Improvement in Churns;* Isaac M. Wade, Clinton, Mich.

Claim.—"The construction and arrangement of the wings or beaters attached to the lower end of the shaft, slats attached to the inner side of the case or tub, and the brakes attached to the dish."

143. For an *Improved Gas Lighter;* Wm. Wilder and Lucien Moss, Philadelphia, Pa.

"The nature of the invention consists in making a portable instrument, for at the same time turning on gas, lighting gas, and carrying matches."

Claim.—"The arrangement of sliding spring catch, taper, and wrench, with the holder."

144. For an *Improvement in Seeding Machines;* Moses D. Wells, Morgantown, Va.

Claim.—"The serrated agitator, adjustable vertically within the slot, for regulating the discharging capacity of the machine. Also, the supplemental slides, for enabling the agitator to preserve a constant reciprocation under all changes of discharge capacity."

145. For an *Improvement in Machines for Cleaning Ore;* Bearnard O. Bryan, Marietta, Pennsylvania.

Claim.—"The arrangement of the solid cast iron horizontal circular plate, having solid raised arms with upright ends, operating in a ribbed cylinder with the frame with centre piece for the purpose of scattering the ore on to the sieve underneath."

146. For an *Improvement in Straw Cutters;* Henry Peckham, Kings' Ferry, N. Y.

Claim.—"One or more knives hung on a pivot in combination with a revolving disk, or its equivalent, carrying one or more slots."

147. For an *Improved Fuse Stock for Comb Shells;* Abraham Powell, Jr., Mare Island, California.

Claim.—"A double cylinder fuse stock, so graduated as to burst shell shot at any required number of seconds."

148. For an *Improvement in Railroad Car Brakes;* Elisha E. Rice, Hallowell, Me.

Claim.—"1st, The construction of the brake with one flanched and one plain shoe. 2d, The combination of the guide bracket extending from the frame of the truck nearly down to the rail, the shoe with its sliding frame; the spring, to allow the shoe to yield, and the beam, for pressing down and raising up the shoe, so that the spring and shoe are supported near the rail, and the shoe rigidly held from any lateral movement whatever, while it is free to rise and fall. 3d, The weighted drop lever in combination with the shoes."

149. For an *Improved Adjuster of Window Blinds;* Alfred A. Starr, City of N. York.

Claim.—"The application of the spring friction bolt to one of the slats of the shutter or blind, in such a manner, that it shall turn with the slat and allow of the slat being adjusted to any angle, and, at the same time, bear with considerable force against the inside edge of the side strip of the frame of the shutter or blind."

150. For an *Improvement in Window Blinds, Doors, &c;* LaFayette Stevens and Solomon B. Ellithorp, Elmira, New York.

Claim.—"1st, The forked lever with the ferrule on the end, or the fork with a flat shaft at the end, made of either cast or wrought metal. 2d, The application of the rods, made either of metal, wood, leather, or their equivalents. 3d, The ground style with the fillet attached."

151. For a *Wheelwright's Guide Mandrel;* Joseph Sykes, Mercer, Pa.

Claim.—"The combination of the mandrel with its permanent and loose journals, and the circular plates or cones, either plates or cones being used as circumstances require."

152. For an *Improvement in Machines for Cutting Grain, Grass, &c.;* Charles Taylor, M'Keesport, Pennsylvania.

Claim.—"The use of a series of knives or cutters connected with the frame of the machine at the point or angle formed by the connexion of each pair of cutters, but not connected with the machine or with each other at the heel, and removable at pleasure."

153. For an *Improvement in Hand Machines for Pegging Boots and Shoes;* Reuben H. Thompson, Buffalo, New York.

"The nature of the invention is, 1st, A device for gauging the distance between the pegs, and causing the machine to move accurately the proper distance after the peg has been driven, for the insertion of the next peg. 2d, A device for feeding the peg wood to the knives which cut off the pegs."

Claim.—"1st, The spring spacer or stepping instrument. 2d, The spring feeder."

154. For *Improvements in Packing for Stuffing Boxes, &c.;* Joseph H. Tuck, Pall Mall, England.

Claim.—"The forming of packing for pistons or stuffing boxes of steam engines, and for like purposes, out of saturated canvas, so cut, as that the thread or warp shall run in a diagonal direction from the line or centre of the roll of packing, and rolled into form, either in connexion with the india rubber core, or other elastic material."

155. For an *Improved Steam Boiler Furnace;* Thomas Champion, Washington, D.C.

Claim.—"Using the exhaust steam in a closed stack, as a blower to return the heated gases or products of combustion with which it commingles back through flues or passages to the fire again and again, to be reburned."

156. For an *Improvement in Attaching the Raker's Seat to Harvesters;* Stephen Hull, Poughkeepsie, New York.

Claim.—"The placing or fastening of the raker's seat on the bar, by means of a bar of iron or steel, or any other equivalent device, near the inside of the main frame, in such a manner, that the weight of the raker, when on his seat, will rest on the bar."

157. For an *Improvement in the Cutters of Harvesters;* John H. Manny, Rockford, Ill.

Claim.—"Constructing the cutters of harvesters with clearing notches. Also, the combination of clearing hooks with the cutters of harvesters."

158. For an *Improvement in the Guard Fingers of Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"Forming the finger with an oblique neck."

159. For an *Improvement in Corn Planters to be operated by Hand;* Oren Stoddard, Busti, New York.

Claim.—"The arrangement of the follower or plunger, dropping or sliding plates, and agitators or distributers, formed by the levers provided with cross-arms and rods."

160. For an *Improvement in Machines for Making Harness for Looms;* Jacob Senneff, Philadelphia, Pennsylvania.

Claim.—"1st, The method of winding the heddles on the shafts, by revolving the tube through which the yarn is supplied from the spool at its end alternately around the shafts and flanches surrounding the stationary cylinders as they pass through said cylinders, and guiding the same by the followers or guides at its ends, passing through the circular spaces or slots communicating with each other, and delivering the yarn to the shafts during the revolutions of the tube from the end of the grooved radial swinging arm turning loosely on its end. 2d, The combination of the adjustable spring and radial swinging arm with the tube for delivering and tempering the tension of the arm. 3d, The combination and arrangement of the bent rods on the rock shaft, alternately operated upon by the tension of the yarn as it is laid on the shafts, eccentric cam, slotted bar having a notch on its side and enlarged at its lower ends; hub, with inclined surface, corresponding with the inclined surface of the enlarged part of the slotted bar and the horizontal, longitudinal, and transverse sliding rods, the whole forming the essential part of the apparatus for stopping the machine upon the breakage of the yarn."

Re-Issues for June, 1855.

1. For an *Improvement in Looms;* Barton H. Jenks, Bridesburgh, Pa.; dated June 5, 1855; original patent dated April 3, 1855; re-issue dated January 8, 1855.

Claim.—"The yielding rest or support for the picker to break the sudden blow or concussion with which the shuttle impinges upon the picker, thereby preventing the filling of the cop from being jarred off and entangled, and relieving the picker from

danger of being broken. Also, separating and freeing the lever and the picker from the end of the shuttle by the same movement which shifts the shuttle boxes, operating through a combination of levers, cams, and springs, or through levers, cams, or treddles worked from any part of the loom."

2. For an *Improved Nut and Washer Machine;* Henry Carter and James Rees, Pittsburgh, Pa.; dated June 19, 1855; original patent dated August 26, 1851.

Claim.—"Cutting the blank from a heated bar of iron, punching its eye in a closed die-box, pressing it into shape while in the die-box and on the punch, and then discharging it."

DESIGN FOR JUNE, 1855.

1. For *Stove Plates;* Saml. W. Gibbs, Albany, N. Y., Assignor to Skinner and Brothers, Brownville, N. Y.; dated June 26, 1855.

Claim.—"The combination and arrangement of ornamental figures and forms, forming the ornamental design for the plates of a cooking stove."

JULY 3.

1. For an *Improvement in Sand Paper Cutting Machines;* William Adamson, Philadelphia, Pennsylvania.

Claim.—"The employment of thin elastic blades of uniform thickness, so arranged, that the revolving blade shall overlap slightly the stationary blade."

2. For an *Improvement in Fire Arms;* Ethan Allen, Worcester, Massachusetts.

Claim.—"So combining a rotary or movable breech and a charge chamber together and with the barrel of a fire arm, that not only when they (the said breech and chamber) are moved or rotated in one direction, shall the breech uncover the passage into the barrel, and such charge chamber be brought into a position to permit a cartridge to be passed into it and the barrel, but when they (the said breech and chamber) are rotated in the opposite direction, such breech shall be made to cover the passage into the barrel, and such charge chamber, in conjunction with the barrel, be caused to bend, break, and hold such cartridge. Also, the charge chamber and breech block are provided with journals and bearings extending the movable breech beyond the block, in order that not only may said breech serve as a scraper to the inside surface of the case, but that the block may be protected from the injury and friction of the carbonaceous matter resulting from the explosion of a charge."

3. For an *Improved Machine for Sawing Shingles, etc.;* A. C. Billings and B. H. Ruggles, Palmer, Massachusetts.

Claim.—"1st, Giving the proper feed motion to the carriage by means of the inclined or wedge shaped projection on the gate, lever, and pawl, which acts against a rack on the underside of the carriage. 2d, Connecting or attaching the head block to the carriage, by means of the spiral spring, for the purpose of allowing the head block to yield or give when necessary."

4. For an *Improved Self-Regulating Wind-Mill;* Addison P. Brown, Brattleboro', Vt.

Claim.—"1st, The helical slot and pin as a means of governing the degree of obliquity of the fans to the wind. 2d, The combination of weights with the helical slots and pins."

5. For an *Improved Burglar's Alarm;* Ephram Brown, Lowell, Mass.

Claim.—"Arranging the locking and discharging levers, the main and secondary knob rods, the unbolting lever and bolt rod. Also, arranging the key levers with respect to the locking and discharging levers, and combining such key levers with the locking and discharging levers by one or two series of sliding pins, or their equivalents, made to operate through holes in a block arranged with respect to the locking and discharging levers. Also, arranging the alarm apparatus with respect to the locking and discharging levers. Also, arranging the counter wheel or apparatus, and combining it with the alarm apparatus. Also, combining with the lever the third knob, by which said lever may be operated under certain circumstances. Also, arranging the main and

secondary knob rods so that the latter may slide through the former, or the former be made to slide on the latter."

6. For a *Machine for Boring and Turning Wood;* Adolph Brown and Felix Brown, City of New York.

Claim.—"1st, The manner of guiding and turning round the wood by passing said wood through suitable holes made through the wheels, thereby allowing the wood to be fed up to the tools at the same time the same is turned round. 2d, The ring with the tools for cutting off the wood."

7. For an *Improvement in Harvester Reels;* Gardner A. Bruce, Mechanicsburgh, Ill.

Claim.—"Constructing the bars of the reel, having the pivots at the ends of said bars placed at the edges of the ends and fitted loosely in holes at the ends of the radial arms, so that the bars may, by their own gravity, remain in a vertical position as the reel rotates."

8. For an *Improvement in Grain and Grass Harvesters;* Sylvester Colburn, Ansonia, Connecticut.

Claim.—"The employment of the elastic plates fitted within the fingers and acted upon by springs."

9. For an *Improved Mill Step;* Julius C. Dickey, Saratoga Springs, New York.

Claim.—"The application of the roller and lever for adjusting the height of the mill spindle, when the latter rests in the tube and said tube is secured to the tram block."

10. For an *Improvement in Attachments for Lightning Rods;* Robert D. Dwyer, Richmond, Virginia.

Claim.—"Constructing a lightning rod holder of but two parts, of such a form that the lightning rod will connect them to each other at the same time that it combines itself securely with them."

11. For an *Improvement in Locking Latches for Doors;* Edmund Field, Greenwich, Connecticut.

Claim.—"The arrangement of the locking bolt with the catch, when these parts are hung and operate together, and so that the locking bolt with its tumbler, guards, and other appurtenance or appurtenances, when not being used to lock the door, are set in motion by the catch each time it is operated."

12. For an *Improvement in Machines for Washing Sand;* George Finley, Collins Township, Pennsylvania.

Claim.—"The use of the jet block, or its equivalent, for the purpose of distributing the sand and water over the surface of the sieve."

13. For an *Improvement in Knitting Machines;* Thos. Fowler, Cohoes, N. Y.

Claim.—"1st, Combining a revolving radiating series of horizontal fixed hooked needles, and a series of vertical movable hooked needles, that are so operated within and by a revolving slotted cylinder, or its equivalent, and by cams, that the two series of needles shall operate together, and with one or more than one set of appliances, each consisting of one sinker and two pressers, and make cylindrical ribbed work. 2d, Combining and arranging the set of movable needles with the revolving slotted cylinder, and one or more than one set of stationary cams, each set consisting of the cam, and a depression and an elevation in the cam ring, so that the movable needles shall be successively carried outward to cast off the old stitches from the radial needles, and then downward to cast off the old stitches from themselves, and finally, upwards and inwards to allow the yarn to be again fed upon the radial needles in their revolving course."

Improvements Claim.—"1st, The inside guide stitch with the two sets of needles, to help cast off the old stitches of the radial needles, and to increase the distance between the old stitches and the new ones upon the movable needles at the same time their barbs are depressed. 2d, The outside stitch cam, to help cast off the old stitches of the movable needles. 3d, The cam to assist the return of the movable needles to, and to retain them in the position they occupy during the feeding of the yarn upon the radial needle."

14. For an *Improved Book Clasp;* Charles Folsom, Cambridge, Mass.

Claim.—"The book clasp constructed of strips of sheet metal bent at right angles, one being furnished with a slot, and the other with a tightening screw, by which the two may be secured together, to accommodate the clasp to books of different sizes."

15. For an *Improved Horse Power;* **H. H. Fultz**, Lexington, Mississippi.

Claim.—"The application of the driving wheel in combination with the shaft and pinion."

16. For an *Improvement in Steam Boilers;* James Harshiman, Dayton, Ohio.

Claim.—"Forming an external casing or covering of copper for stoves, and all heat-diffusing devices, or apparatuses, and steam boilers."

17. For a *Machine for Cutting Cavities, Spherical, Ellipsoidal, etc.;* Isaac B. Hartwell, Woodstock, Vermont.

Claim.—"1st, The spherical shell or cutter turning at the same time on the axis of the sphere of which the shell is a part, so as to cut a spherical groove or a convex and concave surface of less extent than a quadrant of the superficies of a sphere, yet corresponding in shape to the convex surface of a spherical section formed by two planes passing through the sphere at right angles. 2d, The method of giving a compound motion to the spherical shell or cutter, by means of the tight gear wheel and the loose gear wheel revolving on the axis of the rocking frame, so as to be in connexion with the pinion in all necessary positions of the rocking frame. 3d, The use of circular saws set in an oblique sliding frame, in connexion with the spherical cutter, for the purpose of cutting straight grooves to connect with the spherical grooves at each end of the block of wood."

18. For an *Improvement in Lard Lamps;* James D. Hays, Mt. Morris, Ill.

Claim.—"The combination of the cylindrical chamber, piston, and the valve at the lower end of the wick tube, whereby the lard is retained in the wick tube when the piston is removed back to re-fill the chamber."

19. For an *Improved Apparatus for Setting Bows to Carriage Tops;* Edward Hayes, Wheeling, Va., and Morgan Hayes, Washington, Pa.

Claim.—"Setting or adjusting the bows for carriage tops by means of a framing provided with clamps, adjustable pieces, and adjustable arms or pivots."

20. For a *Method for Regulating the Issue Apertures and of Suspending Turbine Wheels;* Birdsill Holley, Seneca Falls, New York.

Claim.—"The mode of opening and closing the issues and regulating their extent, in combination with the mode of hanging the revolving wheel."

21. For an *Improvement in Grain and Grass Harvesters;* William H. Hovey, Springfield, Massachusetts.

Claim.—"The employment of the "clearers" attached to the bar and working in the recesses of the fingers, for the purpose of preventing the choking or clogging of the sickle, the bar being connected to one or more of the cutters by pivots, by which, motion is communicated to them."

22. For a *Method of Hanging Plane Stocks to their Mouth Pieces;* M. G. Hubbard, City of New York.

Claim.—"The construction and attachment of the plane stock and pressure bar to the bed frame of the planing machine, by which the pressure of the bar is regulated, and the bar and plane stock can be turned back to sharpen the plane. Also, jointing the floating or front plane to springs or bars turning on a pivot to rise or fall over the inequality of the board."

23. For an *Improvement in Machines for Making Rivets;* Fredk. W. Hoffman and Ch. W. Gustav Fordan, County and State of New York.

Claim.—"The knife, so arranged in relation to the lower jaw or jaws and the header, that while it serves as a cutter, it also moves up the inclined plane jaw, and forms a solid support for the rear end of the blank during the making of the head."

24. For an *Improvement in Attaching the Connecting Bar to the Cutters of Harvesters;* James Little and Wylie Little, Princeton, Indiana.

Claim.—"Connecting the pitman or connecting rod to the sickle bar, by means of the cylinderial projection on the end of said bar and the loop at the end of the connecting rods, whereby the pitman may be readily connected to and detached from the bar, and at the same time a durable connexion or attachment of the bar and pitman obtained."

25. For an *Improvement in Screw Fastenings;* John Loudon and Otto Ahlstrom, City of New York.

Claim.—"1st, Constructing the head of a screw bolt of fixed wedges or inclined pieces and loose expanding pieces, whereby the act of screwing up the nut is caused to expand the said heads for the purpose of making it fit tightly in a suitable cavity or hold in which it is placed, or what is equivalent, constructing the nut with the said fixed wedges or inclined pieces and expanding side pieces, so that by screwing in the bolt, it may, in the same manner, be expanded to fit tightly within a suitable cavity. 2d, Forming the fixed wedges or inclined side pieces of the bolt or nut up the sides of the bolt, so as to get a great length of bearing for the expanding pieces with a small sized bolt head or nut. 3d, Confining the expanding pieces to the bolt or nut by means of an elastic ring, which keeps them always in condition to use on the bolt or nut, and which allows them to expand, and to remain parallel during their expansion, and contracts the collar when the nut or bolt is unscrewed, and allows the bolt or nut to be removed."

26. For an *Improvement in Sewing Machines;* Jean Pierre Molliere, Lyons, France; patented in France, May 30, 1854.

Claim.—"1st, The movable fulcrum of the graduated sliding piece, for lengthening or shortening the arm of the lever, in connexion with the catches, of different lengths, whereby the movement of the rack shaft or of the pinion, can be varied at pleasure, so as to produce any length of stitch that may be desired. 2d, The guides of the tooth rack and the rollers for keeping in place the adjustable piece carriers and the tooth rack, which steadily pushes forward the piece to be sowed, so as to secure a regular succession of stitches. 3d, The action of the hook or lever *h*, when the upper needle carrier is ascending upon the lever *i*, whereby the point bearing upon the rods make it press the piece, *m*, against the piece *n*, so as to seize and hold fast the needles between the shoulders of the pieces *m* and *n*, at the moment when the lower carrier has driven them through the piece to be secured. 4th, The lever and its two hooks, for passing beyond the line of sewing, and taking hold of the thread at the moment when the needles are held above the plates, and pulling it after them, and closing up the same, together with the apparatus for overcoming the obstacle arising from short threads. 5th, The stopping levers for arresting the two needle carriers in their course when the thread breaks, which, by throwing the ball out of perpendicular, ungear the catches by the piece, K H, and so bring the machine to a stop. 6th, The sewing of every kind of seam, whether straight or crooked, by what is known as the shoemaker's stitch."

27. For an *Improvement in Trip Hammers;* Milo Peck, New Haven, Conn.

Claim.—"So controlling the admission and exit of air above the piston, that the force of the blow given by the hammer may be regulated by the condensation and attenuation of the air."

28. For a *Machine for Dressing Conical Tapering Surfaces;* Paul Peckham, Petersham, Massachusetts.

"The nature of the invention is to dress or round a tapering stick of wood, so that, while it has one flat surface, the rest of it in transverse section, may be in the form of a segment of a circle."

Claim.—"The arrangement and application of the depressing rest with respect to the hollow tubular cutter stock, so as to enable a person to dress or round a tapering stick of wood."

29. For an *Improvement in Mowing Machines;* Samuel Rockafellow, Coatsville, Pa.

Claim.—"Raising and depressing the finger bar, K, and consequently the cutters, by means of the vertical bars, M M, having wheels at their lower ends, arm P, attached to the cross piece of the bars M M, lever, and shaft, with its arm S, attached."

30. For an *Improvement in Machines for Shucking and Shelling Corn;* John J. Rollow, Fredericksburgh, Virginia.

"The nature of the invention consists in the construction and arrangement of the concave operating in combination with the toothed revolving cylinder in such a manner, that when the corn in the shuck or husk is fed into the machine through the hopper, the husk is first parted down two opposite sides, the same as it is commonly done by hand, and is turned backward one-half each way over the stalk of the cob, leaving the corn on the cob to be rubbed or rolled off."

Claim.—"The diagonal ribbed perforated concave, when hinged at the upper end, and supported on springs at the lower end, in combination with the diagonal ribbed cylinder."

31. For a *Machine for Feeding Sheets of Paper to Printing Presses;* A. H. Rowand, Alleghany City, Pennsylvania.

Claim.—"The employment of the swinging frame provided with the rollers, in combination with the vibrating arm and clamp or lip operated by the slotted bar."

32. For a *Method of Cutting Straight or Curved Mortises;* Edward Q. Smith, Cincinnati, Ohio.

Claim.—"The two segment pieces placed at an angle to each other or straight, so as to direct the lateral movement of the mortising chisel in a curved or right line, and thereby form a curved or straight mortise."

33. For an *Improvement in Corn Planters;* William Stinson, Georgetown, Pa.

Claim.—"The arrangement of the seed rollers and corn box in the spoke of the wheel in combination with the spade."

34. For an *Improvement in Looms;* Samuel T. Thomas, Lawrence, Mass.

Claim.—"Working the picker staff in opposite directions by means of a flexible strap having sufficient stiffness to move said picker staff backward when said strap is moved by a lever. Also, combining with the operating lever and the forked lever of the stop motion, a lever or pitman, and a tripping or rocking lever, or the equivalent thereof, the same being for the purpose of operating the lever of the shipper, and relieving the forked lever of strain; the said improvement enabling to be used a forked lever of great lightness and delicacy of construction, and capable of being operated by the finest qualities of weft and thread. Also, arranging and combining the friction pulley, the band, the levers and spring, or its equivalent, so as to operate together, and with respect to the yarn beam."

35 For an *Improvement in Looms;* Samuel T. Thomas, Lawrence, Mass.

Claim.—"Combining with each rocker lever and the lifter thereof, an arm, cam, and sector, or the equivalent or equivalents thereof, the whole being applied together. Also, combining with the series of lifters and the pattern prism, a series of bent levers, or their equivalents, and imparting to the pattern prism vertical or up and down movements. Also, when the upper and lower sets of cords of a harness are supported by pulleys, applying both said upper and lower sets of cords to one and the same end of a lever operated by a cam having a continuous rotation. Also, combining with the star cam and lever for moving a set of shuttle boxes, a mechanism for imparting an accelerated movement to the set of shuttle boxes, the said mechanism consisting of an additional lever, a movable wedge and its operative mechanism. Also, the arrangement of a jacquard, the wires thereof, the impelling pawls, and the star cams and their shaft, where one jacquard apparatus applied at one end of the loom is made to operate two independent shuttle motions of the loom. Also, so applying to the main shaft a friction clutch wheel and a fly or balance wheel, that the fly may run loosely upon the shaft, and be capable of being moved either towards or away from the friction clutch, in combination with so connecting the fly with the shipper, that the said fly shall be moved laterally during and by the movements of the shipper. Also, combining with the friction wheel and the shipper, a brake mechanism, for throwing said brake into and out of operation, such mechanism consisting of the lever latch, the projection, and spring."

36. For an *Improvement in Spring Bed Bottoms;* Hiram Tucker, Cambridgeport, Massachusetts.

Claim.—"Arranging and connecting the inflexible bar, and lifter, and counter sway springs, (or their equivalent,) together and within the frame, so that each, when a mattress is laid upon it, shall extend under and give support to such mattress and operate as an elastic foundation therefor."

37. For an *Improvement in Horse Collar Blocks;* T. J. Van Beuschoten, Poughkeepsie, New York.

Claim.—"The arrangement and operation together of the obliquely sliding back jaws along either side or edge of the collar on its interior with the stationary front jaw to the narrow or upper end of the collar. Also, giving to the obliquely sliding jaws, acting separately but in concert, increased freedom of action or play on their ways, to effect

simultaneously the lateral and longitudinal stretch of the collar by connecting the freely supported operating screw nut with the obliquely sliding jaws by spring arms."

38. For an *Improvement in Paddle Wheels;* John Upham Wallis, Danville, N. York.

Claim.—"Attaching the innermost or central portion of the buckets rigidly to a single wheel or central rim, and staying the outer portions thereof to the said rim by stays, whereby the construction of the wheel is simplified and great strength is obtained."

39. For an *Improvement in Ploughs;* Nicholas Whitehall, Attica, Indiana.

Claim.—"The arrangement and connexion of the handles, arms, plough beams, and seat."

40. For an *Improvement in Cooling and Drying Flour;* George Butler Willison, Elizabeth, Pennsylvania.

Claim.—"The application of a draft of cold air over and around the upper mill stone, in grist mills, between the stone and the curb, to prevent sweating on the stones and curb, and to cool and dry the flour by means of the fan, in combination with the annular and tangential flanches inside the curb, to serve as a guide for the current of air and the ventilating tube or tubes."

41. For an *Improvement in Apparatus for Heating Feed Water to Steam Boilers;* Robert Wilson, Columbus City, Iowa.

Claim.—"The arrangement of the feed water pipe, opening within the exit steam pipe, in relation to the exhaust steam pipe within the feed water reservoir, whereby the entire exhaust steam may be condensed, and the entire feed water pass through."

42. For an *Improvement in Stoves;* Robert Wilson, Columbus City, Iowa.

Claim.—"The combined cylinder stove and oven, lined with removable rolls of sheet iron."

43. For *Improvements in Sewing Machines;* Jerome B. Woodruff, Washington, D. C.

Claim.—"The making of the needle bar hollow and providing it with a door or slide, for the purpose of holding incased therein such parts of the machine as may be desired, whether the needle bar be ornamental or otherwise. Also, the direct and positive connexion of the needle arm and shuttle carrier, by which means they both move simultaneously and in perfect harmony with each other, so that whichever way the pulley is driven, the operation of the machine will be the same."

44. For a *Machine for Beveling and Polishing the Inner Edges of Daguerreotype Face Plates or "Mats;"* Edward Brown, Assignor to the Scoville Manufacturing Company, Waterbury, Connecticut.

Claim.—"The combination of the rotary burnisher, and vibrating or yielding frame."

45. For a *Machine for Mitering Printers' Rules;* Wm. McDonald, Assignor to R. Hoe & Co., City of New York.

Claim—"Attaching to the bed A, and framing a sector guide plate E, to which plate B, the bed F is secured by a set screw, the bed F having a curved projection attached to it, which projection works in a recess or groove in the plate E, by which the bed F, may be adjusted at the desired angle with the plate A, and the ends of the rules beveled or cut."

46. For a *Water Metre;* James Curtis and Samuel Hourd, Chicago, Illinois.

Claim.—"1st, The employment of two chambers, having such communication with each other that the incoming water entering each cylinder or chamber, in its turn, will expel a volume of air previously contained therein, and drive it into the other cylinder or chamber, and cause the said air to act as a piston to separate from the incoming water and to discharge, through the agency of the pressure thereof, the water in the other cylinder or chamber. 2d, Fitting a float valve to each end of the pipe through which the air is transferred from one to the other of the two measuring cylinders or chambers, so that in whichever cylinder the water should rise above its proper level by reason of the derangement of the inlet and outlet valves, the pipe will be closed and the flow of water stopped."

47. For an *Improvement in Cotton Presses;* Augustus M. Glover, Waterborough, South Carolina.

Claim.—"The use of the roller moving with the platen, in combination with the rack

and pinion, for the purpose of preventing the platen touching the sacking in its descent, and keeping the platen in position when below the hopper, and the sides of the bale box removed."

48. For a *Cork Machine;* John Power, Boston, Massachusetts.

Claim.—"1st, Supporting the bed of the knife carriage near its centre, upon a bearing screw, and applying adjusting screws near its ends, for the purpose of making it adjustable at different heights, and either level, or at different inclinations. 2d, Giving rotary motion to the mandrel, or its equivalent, which revolves the cork by means of a band connected with the knife carriage and carrying a weight, the weight serving to keep tight the band and transmit motion from the knife carriage to the cork during the cutting operation, and also to draw back the carriage after the cutting operation."

49. For an *Improvement in Sewing Machines;* George W. Stedman, Vienna, N. J.

Claim.—"Mounting a bobbin, or its equivalent, and combining it with a reciprocating plate or looper, which is provided with a pointed projection extending before said bobbin, and arranged so as to enter the loop of the needle thread, then carry the bobbin over the outside of, and finally back through said loop, whereby the liability to miss the stitch and break the needle, together with the noise and friction of a shuttle, is avoided, the use of oil for lubricating the shuttle race dispensed with, and the consequent soiling of the thread prevented. Also, constructing the bobbin with one face sunk below or flush with the edge of the other face, its thread consequently unwinding from its face, instead of its periphery, for the purpose of preventing the loop of the needle thread getting inside of the bobbin."

50. For an *Improvement in Marine Engine Governors;* Thomas Silver, Philadelphia, Pennsylvania.

Claim.—"The employment of two oscillating balanced bars in combination with the spindle and spring, or any equivalent therefor, in such combination."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Some Experiments upon Coffee as a Beverage. By Augustus T. Dalson and Charles M. Wetherill, Ph. D., M. D.

(Continued from page 65.)

The next experiment was performed upon a large scale, to ascertain whether the aroma lost in roasting coffee might not be collected advantageously. Fourteen pounds of coffee were roasted in two operations by *gas heat* in the following apparatus, which (without the condensing part) will be found admirable for use by those having coal gas at command, as the operation is a cleanly one and the temperature entirely under control. A cylindrical sheet iron vessel made air-tight for the experiment, was supplied at each end with an axis, to one extremity of which was adapted a handle for the purpose of turning, the other end was made of an iron tube $1\frac{1}{2}$ inches in diameter and a foot long; the inside of the drum where this tube communicated, was fitted with an iron cap of 3 inches in diameter, standing out from the end of the drum, and pierced with holes to prevent the coffee from falling into the tube while suffering the vapors to escape. Two places of the axis near each end of the drum were turned smooth on the lathe, to allow the drum to rotate easily. About three inches of the end of the tube externally, were also turned smooth, so that it might be adapted to the neck of a large receiver by means of a cork in which it turned with an air-tight joint. From this receiver (which was cooled by water for the last half of the 14 lbs.) a

rising tube permitted the vapor to pass into a Liebig's condenser and thence into two receivers cooled with salt and ice, and to escape through an organic analysis potash apparatus cooled in the same manner. This drum rotated in a rectangular stove made of sheet iron, with a hood of the same material, which was heated with a gas burner made in the shape of a gridiron of six tubes, communicating with each other and running longitudinally at the bottom of the oven and pierced with holes for the flames at an inch apart.

The first charge of seven pounds was roasted in an hour and thirty-five minutes. The coffee appeared well and gave an excellent infusion; it weighed 6 lbs. 2½ oz., corresponding to a loss of about 12 per cent., which agrees with Cadet's experiments, which gave 12⅓ per cent. loss for coffee roasted to reddish brown color. The result of the roasting of the second charge of seven pounds was not weighed, it gave a coffee in every respect like the first. The following are the results of the distillation, the same liquids of the two experiments being united. The receivers immediately attached to the drum contained about two fluid ounces of dark colored liquid, acid and odor empyreumatic but not very unpleasant. The taste was not at all like that of coffee; a small quantity of solid fat floated as a pellicle on the surface of the liquid. The receiver nearest the Liebig's condenser, contained a quarter of an ounce of light brownish yellow liquid of odor and reaction somewhat similar to the last; on standing, a few flakes deposited which dissolved in alcohol with a brown color. The next receiver contained a few drops of nearly colorless liquid which remained frozen while in the freezing mixture, and when melted possessed an odor somewhat like the others, but even more remote from a coffee smell. The Liebig's bulbs contained nothing, but smelled of the aforesaid hydro-carbons, which are probably the same as those described in Payen's experiments. In no instance could a liquid be obtained of sufficient quantity or reaction to warrant the advantage in a practical light, of collecting the aroma which might be therein. It appears in reality that but a small quantity of the aroma is lost in the roasting, and what is lost is mingled with very disagreeably smelling vapors, from which it would be very difficult to free it.

It became next interesting to ascertain whether a portable coffee could not be obtained by making an aqueous extract of raw coffee, evaporating to dryness and roasting the residue. Fifty-three grammes of raw coffee were pulverized and extracted with 200 grms. of cold water, and 25 per cent. of extract was thus obtained. The same quantity of raw coffee which had stood in the thermostat at 105° for 24 hours was powdered and gave 27 per cent. of extract. Another portion of 307 grms. was extracted in a displacement apparatus. These several extracts were roasted in the Florence flask rotated by the jack. The following is the result of some six experiments in which the temperature was varied in different ways. The dried extract began to stick to the sides of the flask when warm, and at 185° it smelled very much and formed bubbles like tannic acid when dried. If kept at 200° for a short time and even when heated as high as 230°, white fumes began to appear. The porous residue in the flask when dissolved in a little warm water, gives a delicious cup of coffee somewhat resembling that made in the usual manner but less acid and more bland

to the taste. At 240° the coffee began to get bad, and the same effect took place if the temperature was lower but more prolonged. The great drawback to this mode of making coffee arises from a dark slimy residue which does not dissolve in water, and which, although tasteless, has a disgusting appearance. It is more trouble to filter the liquid from this substance than to make the coffee in the usual manner, and besides, it filters very slowly, stopping up the pores of the filter whether it be of linen or of paper. A great many different methods where tried to develop the good properties of the extract without forming this substance, but in vain. When the dried residue of the raw coffee berries from which the substances soluble in water had been removed was roasted, and an infusion made in the ordinary manner, it gave the most disgustingly tasting liquid that can be imagined. An experiment was now made to ascertain whether a very concentrated aqueous solution of coffee could not be made by cold displacement, thus extracting more soluble matter than is done in the household, and at the same time obtaining a portable coffee.* A pound of ground roasted coffee was placed in each one of a series of five displacement apparatus, and river water poured through them, a pint at a time, using that which had run through the first to pour upon the second, and so on through the series. The coffee swelled and each pound absorbed a quart of water during the swelling which it did not suffer to drop, but which was displaced by fresh water. By this means the first liquid which reached the end of the series, was very concentrated and its strength diminished with the liquid following. As soon as a quart and a half had been passed through one of the series, the absorbed liquid remaining in the coffee was pressed out by a hydraulic press of nine tons power, and the droppings added to the following numbers of the series, which were in turn treated in the same manner. The operation lasted 36 hours and the extract was collected in nine portions in the order of the following table, which represents, 1st, the quantity in fluid ounces of each portion; 2d, its contents in grms. of solid matter in an ounce evaporated and kept for 12 hours in the thermostat at a temperature of 100° C., and, 3d, the whole amount of dry residue in each of the nine portions as calculated from the experiments in No. 2, column 4, represents the amount of solid matter in one cup of 4·5 fluid ounces of each of the portions.

Successive Portions.	No. 1. Fluid ounces.	No. 2. Grammes of solid matter in one fluid ounce.	No. 3. Grammes of solid matter in the whole of each portion.	No. 4. Grammes of solid matter in one cup.
1	64·	3·382	216·448	15·129
2	37·	1·984	73·408	8·928
3	36·5	1·262	46·063	5·679
4	36·	0·778	28·008	3·301
5	35·	0·372	13·02	1·674
6	36·5	0·21	7·665	0·945
7	16·	0·127	2·032	0·571
8	12·	0.101	1·212	0·454
9	14·	0·079	1·106	0·355

* C. M. W. is accountable for this experiment.

There were in all, 24 pints of water added, and the resulting portions of coffee solution amounted altogether to about 18 pints, from which it follows that notwithstanding the powerful pressure, the coffee residue retained six pints of water, or $1\frac{1}{8}$ its weight. When this coffee residue was dried it was much lighter in color than ordinary coffee, and a cup of infusion made with it in the ordinary way, had not the slightest flavor of coffee, and resembled in taste the decoction that one is served with in country taverns in the interior of this state.

Lehman obtained by the extraction of roasted Java coffee with boiling water, $21\frac{1}{2}$ per cent. of dry residue, and Payen obtained 37 per cent. Calculations from the above table give a per centage of 17·18 extract from roasted Mocha coffee.

No. 4, represents the amount of solid matter in a cup of $4\frac{1}{2}$ fluid ounces for the different portions. An experiment with the biggin, showed that when six fluid ounces of boiling water are poured upon about half an ounce of roasted Mocha coffee, a little over four and a half fluid ounces of coffee may be poured from the biggin; this is an ordinary cup full, and one fluid ounce evaporated and dried at 100° C., gives 0·131 grms. of residue, whence the cup full contains 0·589, equal to only 4·16 per cent. extracted from the coffee.* If on the other hand, coffee be made by boiling, using the above proportions (but not clarifying with white of egg in order to obtain results for comparison) a little less than 5 ounces of decoction are obtained, one fluid ounce of which contains 0·334 grms. of dried residue, or a cup of $4\frac{1}{2}$ ounces contains 1·503 of residue; this corresponds to a per centage of 10·62 extracted from the coffee. It will be seen from this that, in the preparation of the coffee by boiling, about two and a half times as much matter is extracted from the berry as by the biggin, but even thus, less extract is obtained than by a prolonged displacement, which gave 17·18 per cent. The flavor of both biggin coffee, and that made by boiling is very good, the latter is somewhat more astringent, which taste is preferred by some, while the former has a more ethereal and delicate flavor.

Now to turn to the experiment tabulated on a former page, it will be seen that a cup of biggin coffee is equal in strength to portion 7, (column No. 4,) while the boiled coffee is equal to portion 5. The flavor of the different portions of the table was now tried by making a cup of coffee with them for the evening meal, by warming (diluting with water in some instances) and adding sugar and boiled cream. The weakest portion, 9, was first taken; the flavor was extremely bad, it was very weak, unlike coffee, and left a burning sensation in the throat which lasted during the whole evening. The flavor resembled that of the infusion made from the dried coffee grain residue of the displacement series. In proceeding to portion 1, this flavor gradually gave way to, or was marked by, the true coffee flavor. Portion 1, in the proportion of one volume to nine or ten of water gave a very good coffee, although inferior to that made by the biggin or long boiling. This dilution corresponds to a proportion of dried extract contained in coffee made by boiling, *i. e.*, 1·5 dried ex-

* Payen obtained in a similar experiment, filtering ten times its weight of boiling water upon coffee; for brown coffee 16·5; for chestnut brown 19; and for red 25 per cent. of dry extract. See Erdman and Marchands' Journal, xxxviii, 466.

tract in a cup, so that by rejecting all but portion 1, the rest having more or less of an unpleasant flavor, there is no gain by preparing coffee in this manner, and even portion 1, would have been better, had the extraction been carried less far. The only advantage, therefore, would be in the portableness of the article, which, in some cases, would compensate for the extra expense. A pint of portion 1, was placed aside, with a pound of sugar, in a bottle not particularly well corked; the same quantity was placed in another bottle with half a pound of sugar. The last showed a slight tendency to mouldiness; that with a larger proportion of sugar kept very well. The effect of a teaspoonfull of this liquid, without warming or dilution, is peculiarly exhilarating and refreshing. A solution of this strength would, no doubt, be a valuable addition to the pharmacopœia, as it might be given in whatever dilution was desired, or undiluted when necessary, or where a speedy action was required, and would enjoy the great advantage of affording a medicine of known strength. The proportion for forming the infusion given in the United States Dispensatory, is an ounce of coffee to a pint of boiling water, but if the infusion be made by the servants of the house, its strength must be very uncertain, owing to their uncertainty in roasting the berry. In traveling and exploring expeditions such a solution would also be useful.

With regard to the amount of substance (tannin, &c.,) precipitated by acetate of lead from portion 1, eleven fluid ounces yielded 23·05 grms. of lead salt, dried at 100°, and 0·857 of this salt contained 0·4625, or 53·97 per cent. of oxide of lead, corresponding to a mixture of lead salts of caffeotannic acid. It appears hence, that eleven fluid ounces of the coffee solution contains 10·61 grms. of substance precipitated by acetate of lead, or one ounce contains 0·965 grms. But from the table, a fluid ounce of this extract (portion 1,) contains 3·382 grms. of solid matter, consequently about one-fourth of the extract is caffeotannic acid more or less altered by the roasting. The filtrate from the precipitate by acetate of lead evaporated to dryness, heated, gave an abundant sublimate of caffeine in polarizable needles.

The preceding experiments have added but little to what is already known of coffee in its aspect as a beverage. The following rules may be acceptable to those desirous of insisting upon having their coffee made properly. The roasting should take place in a cylinder constantly turned, over a bright fire; when a white smoke begins to issue from the joints of the cylinder its contents must be carefully watched, and every few minutes a few grains extracted and their color and brittleness examined. As soon as they break easily into several fragments by a slight blow, at which time the color will be of a light chestnut brown, the operation is completed and the coffee, if it is in considerable quantity, must be cooled, by taking portions up in a large tin cup, and letting them drop through the air. The quantity of aroma which might be supposed would be lost in this way is inconsiderable, and the danger of over-roasting, if the coffee be left in a heap or covered up, is great. The coffee, both roasted and ground, may be kept in quantity without loss of flavor if the vessel be corked air tight. In preparing the infusion whether by the biggin or by boiling, both the coffee and the water should be *measured*, in the proportion of half an ounce (in weight) of coffee to a cup full of six

fluid ounces of water for each cup of the infusion. A small measure containing somewhat less than an ounce of water will hold half an ounce in weight of ground coffee.

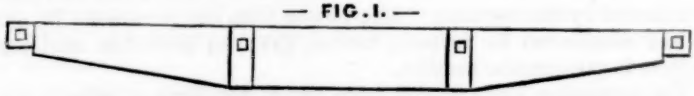
Those articles offered in the market under the name of "*extract of coffee*," and which profess to enable one by adding them to ground coffee to save in the preparation of the beverage, are all worthless and catch-pennies. They contain burned sugar, chickory, carrots, sometimes coffee, and other materials, and act only by giving a dark color to the infusion, and a peculiar taste, which misleads persons to think that the coffee made by their aid is stronger. The excellence of coffee as a beverage, depends upon its caffeine and a peculiar volatile oil, which are not contained in the above-mentioned additions. As early as the year 1782, one of these coffee essences was analyzed and found to contain alkaline carbonate, and it has been lately proposed by Pleischl to add carbonate of soda to the ground roasted berry in the proportion of 43 grains of the former to a pound of the latter, but it may be questioned whether this is a valuable addition, since Bœhmes observed that a small quantity was useless, while a larger quantity communicated an unpleasant taste to the coffee.

For the Journal of the Franklin Institute.

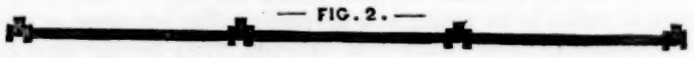
Description of J. C. Schlough's Patent Self-Retaining Grate Bars. By H. Howson, C. E., Philadelphia.

The rapid destruction of furnace grate bars, through excessive heat which causes them to warp and become otherwise deteriorated, has been since the general introduction of the steam engine, a source of great annoyance and expense to engineers.

— FIG. 1. —



— FIG. 2. —



— FIG. 3. —

Various devices for preventing this evil have at different times been tried, with but little success, however, as the present general use of the common bar amply demonstrates.

The invention of Mr. Schlough, for which a patent was granted in May last, has the merit not only of simplicity, but judging from the numerous testimonials he produces, of efficiency also. Figs. 1, 2, 3, in the annexed engraving, represent a side view, sectional plan, and ground plan, of the self-retaining bars. The exterior form differs in no respect from that of common bars; on one side of each, however, are mortises, and on the opposite side tenons at the part where the bars touch each other, so that when a set of these bars are placed side by side, with the

tenons of one fitting into the mortises of the next, it will be impossible for one bar to rise above another, thus maintaining an uniform level at the top, and preventing them from warping. The mortises and tenons are so arranged and constructed, that the bars may have a slight longitudinal, but no vertical movement independent of each other. In placing the bars in their proper position, to form a grate, it should be observed, that the whole number, with the exception of one, may be slided together sideways, the last bar being put in from the top, and acting as a key, must necessarily be without tenons at the side.

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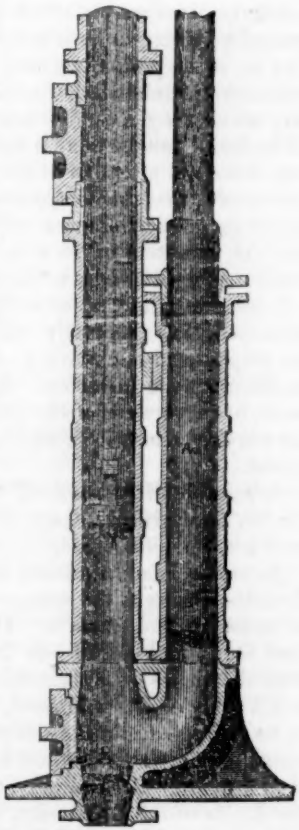
*Combined Forcing and Lifting Pump.**

The annexed sketch represents a combined forcing and lifting pump for draining mines. I have not seen a similar arrangement before, and as it may be useful in many situations, perhaps you will give it a place in your *Journal*.



It requires little explanation. The plunger, A, and the bucket, B, are both connected to the same end of the engine beam, and they rise and fall together. The bucket rods are in the inside of the rising column of pipes; the clack, C, is common to both. When the plunger, A, with its bucket, B, ascends, the water flowing through the clack, C, follows A and B. In descending, the clack, C, shuts, and the water displaced by the plunger flows through the bucket lids, which are open. In the next ascent, the bucket discharges its quantity of water so that the flow of water is continuous, and we have thus a forcing pump and a lifting pump working from the same power, with only one clack between them.

Many modifications of the same principle will suggest themselves. For example, the bucket rod may work through a stuffing-box, and be attached to the same dry rods to which the plunger is attached; and this is particularly applicable to lying pumps, where the rods are always carried outside of the pipes, and work the bucket through a stuffing-box.

An objection to the plan is the extra friction of the water passing through the bucket lids, when both the bucket and plunger are of the same diameter. This may apply when the velocity

* From the Lond. Practical Mechanics' Journal, April, 1855.

of the current exceeds 80 feet per minute, but at a less velocity the friction is not much felt, and there are few of the pumps worked with bell cranks at this speed.

RALPH MOORE.

Glasgow, March, 1855.

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*Correction of the Compass in Iron Ships.**

(Continued from page 58.)

The importance of the Astronomer Royal's remarks on the 'Correction of the Compass in Iron Ships,' published in the *Athenæum* of October 28, can hardly be overrated. Inapplicable as such structures may be for actual hostile encounter, their value as transports, as swift despatch boats, and as merchant vessels, is undisputed:—yet that value must depend, in some measure, on the compasses by which they are steered.

All seamen and the majority of the public are aware, that the magnetic needle is considerably affected by the iron of a ship,—but they do not so generally realize in their minds the fact, that a common steering compass may be some points in error, owing to the vicinity of iron, and that, if such error be unheeded, the ship, with perhaps a thousand souls on board, may be steering a fatal course, (as in the case of the *Birkenhead*,) while all on board believe there is no cause for unusual watchfulness. To those who have not attended to the subject of magnetism it may be pardonable to observe, that the compass-needle is not only drawn towards the poles by the magnetic influence which affects it under any circumstances, but that the attraction of the iron in the ship is an active agent, drawing the needle more or less from the position it would have, if free from any local influence besides that of ordinary terrestrial magnetism. This special attraction, now generally called deviation, is usually the greatest when the ship's head is eastward or towards the west, and least when nearly in the magnetic meridian. Moreover, it varies as the ship heels, or careens over, because of the varying position and influence of the iron and the varying relative position of the compass-needle, which remains horizontal.

Admirable illustrations of these effects have been given frequently by Sir W. Snow Harris, Capt. W. Walker, and Dr. Scoresby, besides other well known authorities.

As some, many, indeed, of the iron ships have inconveniently large deviation errors of the compass, it is indispensable to guard against them in some special manner. Her Majesty's ships are "swung"—that is, they are turned round—so that the bearing of an object may be taken with the ship's head successively on the principal points of the compass, and a table of errors formed, by which the courses afterwards steered are to be corrected, until the ship is swung again, or has changed her locality considerably. This method has been followed for many years—for more than a quarter of a century—sanctioned by those who were supposed by the Lords of the Admiralty, to be the best judges of the subject, especially Col. Sabine. So decided has been this view of the question, that the Board of Trade is now issuing recommendations to merchant ships to

* From the Lond. Athenæum, Nov. 11, 1854.

avoid the other plan,—which shall now be described. This other method is a mechanical correction of the errors, caused by the magnetic influence of iron in the ship herself, by means of magnets fixed near the compass. The high authority of the Astronomer Royal is given in favor of this manner of correction by magnets,—and is as decidedly expressed against the custom of her Majesty's Ships. There is no mistake on this subject. Both views are before the public in print. Both cannot be right. Which are practical seamen to adopt? The sooner the question is settled the better for all whose business is on the great waters, and for the improvement of navigation.

Respecting the process of "swinging" a ship, it may be observed that so much time and minuteness of detail as are now usually given are not necessary. Observations on a few well-chosen points of the compass are sufficient. From them a table or a diagram may be constructed. But the best time for swinging and turning a ship is when she is out of harbor with everything on board. A distant object may then be used as a mark, or transit bearings of known positions observed. While at sea the heavenly bodies, when not obscured, afford means of checking the compasses continually, especially (in this hemisphere) the polar star.

When a distant terrestrial object is visible, the deviation of the compass on any or every point may be quickly obtained by the difference between bearings with the ship in the direction which causes no deviation, and a bearing or bearings with the vessel placed otherwise. This is a simple method, though efficient. Alteration in the ship's local attraction or magnetism may take place from time to time; but, unless iron be moved near the compass, the position in which the ship herself acts on the needle, in the same direction as the general influence of terrestrial magnetism, remains nearly unchanged. A sailing vessel may often try one or two bearings in this manner without much inconvenience. A steamer may do so easily, as well as frequently.

It should never be thought safe to trust implicitly, or for a length of time, to any condition of magnetism. So subtle and variable an influence —subject to sudden or gradual change—whether from jarring blows, from vibration or from electrical action—ought always to be suspected, and therefore watched vigilantly. The Astronomer Royal expresses his opinion, that the sea does not cause such sudden blows as Dr. Scoresby refers to; but he will not be supported by nautical men in such a view. They who have felt the sudden shocks of heavy waves cannot be mistaken on that point.

Correcting Magnets—such as are recommended by Prof. Airy—are found to be very useful in ships employed within moderate limits of latitude, as in the North Atlantic and the Mediterranean; but they are always liable to uncertain change. A flash of lightning may destroy or reverse their polarity; yet the injury may be undiscovered till too late. In using magnets as correctors, it should be borne in mind that, if the ship's deviation is great, very powerful magnets must be employed to counteract it, or those used, if of inferior power, must be placed very near the compass; and then, when the ship heels much, for some time consecutively, the effect on the needle may be very much altered by being brought nearer to the magnet. The Astronomer Royal says, that "a quarter of an inch

in the height of the compass may very greatly disturb the neutralizing influence of the magnets." When thus affected, the compass may indicate a bearing or course considerably different from that which it would show were the ship upright. Prof. Airy approves highly of Dr. Scoresby's experiments; yet their tendency, as stated to a large audience at Liverpool, was certainly to discredit the employment of the Correcting Magnets. In a surveying vessel, employed a quarter of a century ago, a neutral point was the station of the Principal or Standard Compass, at which point there was little or no effect of deviation visible, because there were balanced local attractions abaft, before, and on each side of the compass. The advantages of such a neutral point were suggested by the plan of Prof. Barlow, namely, the correcting plate, used by the lamented Captains Foster and Basil Hall. In all parts of a prolonged voyage round the world, the neutrality of that selected point remained unaltered, and its utility was undisputed.

In these remarks I have endeavored to avoid such technical terms as are not familiar to general readers, and all discussion of abstruse questions relative to induced or other kinds of magnetism. My sole object is to assist in drawing competent attention to a very important subject, immediately affecting life and property at sea.

I am, &c., ROBERT FITZ ROY.

Athenæum Club, Nov. 2.

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It was only on Friday last (being from home) that I had an opportunity of seeing the article in the *Athenæum* of October 28, by Mr. Airy, in which my name repeatedly appears, "On the Correction of the Compass in Iron Ships." The elegance of the investigations of Mr. Airy on the magnetical condition of the "*Rainbow*," having been known to me, and, I may add, fully appreciated by me from the time of the first publication of the results, it is no small satisfaction to me to have the opportunity thus given by that article, for the fair discussion of the principles and mode of working of the method of compass adjustment by permanent magnets, on which we, unfortunately, so greatly differ at present. The discussion will, I doubt not, be of much use in carrying forward the movement, which the case of the "*Tayleur*," deemed by Mr. Airy to have been unfortunately selected, has, I believe, most fortunately given rise to. Good, I am persuaded, has been already obtained in this most enterprising port from what has already been done, and still further good may be expected from a calm and candid discussion of the questions betwixt us.

At present, however, whilst from home, it is not in my power to go into a subject so important to commerce and humanity satisfactorily. But shortly I shall beg some space in your columns, in order to state the grounds on which I have arrived at conclusions so different from those stated in the article referred to; and to endeavor to establish the views of the case which so long I have been publicly urging, and which, if so established, must be held to possess a high degree of importance in their bearing on so great a national interest as the safety of the navigation of ships built of iron. I am, &c., WILLIAM SCORESBY.

Liverpool, Nov. 8.

(To be Continued.)

For the Journal of the Franklin Institute.

Comparison of the Performance of the U. S. Steamers Mississippi, Susquehanna, and Powhatan.

By the kindness of one of the engineers attached to the Japan Squadron in 1854, we are enabled to present an interesting comparison of the performance of the above named steamers, abstracted from their steam logs, during a cruise, side by side, from Loo Choo to Japan, February 7th to 13th, 1854, during the whole of which time they were within hailing distance, and, of course, influenced by the same winds, currents, &c. It is rarely that such opportunities occur, or that when they do occur, such accounts are kept of the conditions of the engineering department as can be relied upon. Taken in connexion with the dimensions, &c., of the respective vessels previously furnished in this Journal, the abstract given below will not be devoid of interest or instruction.

Steamer Mississippi.

Date.	Hours of steaming.	Steam pressure in pounds per square inch.	Revolutions per minute.	Per hour. Pounds of coal.	Speed, in feet of wheels.	Speed, in feet of ship.	Slip of wheel in per ct.
Feb. 7,	12	10·85	8·74	2560	45,033	38,635	14·2
" 8,	24	9·20	8·60	2174	44,250	43,379	0·5
" 9,	24	6·33	9·67	1583	49,627	48,845	0·4
" 10,	24	8·43	8·93	2230	45,827	41,532	9·3
" 11,	24	11·90	8·61	3030	44,738	34,489	22·9
" 12,	11	12·18	7·76	2804	39,976	23,297	41·7

Steamer Powhatan.

Feb. 7,	13	12·60	8·58	3231	46,630	35,820	23·0
" 8,	24	11·16	9·11	3411	49,558	43,379	12·5
" 9,	24	——	9·77	2523	53,096	48,845	8·0
" 10,	24	10·71	8·86	3183	48,694	41,532	14·7
" 11,	23	12·43	8·84	3990	48,310	35,980	25·5
" 12,	10	11·64	7·78	3359	41,392	23,297	43·7

Steamer Susquehanna.

Feb. 7,	13	9·46	9·04	3241	47,600	35,820	24·7
" 8,	24	9·32	9·32	2970	49,462	43,379	12·3
" 9,	24	9·92	8·86	3475	51,614	48,845	5·3
" 10,	24	9·46	9·20	3010	50,818	41,532	18·3
" 11,	24	9·92	8·86	3975	47,054	34,489	26·7
" 12,	11	9·64	7·99	3682	42,426	23,297	45·1

Averages.

Mississippi,	9·44	8·84	2336	45,330	39,982	11·79
Powhatan,	11·60	8·96	3248	48,781	39,982	18·05
Susquehanna,	9·63	8·96	3310	48,840	39,648	18·82

From the above tables it will be seen, that the performance of the

Powhatan and *Susquehanna* was nearly identical, but slightly in favor of the latter, and that in both, the slip was over 50 per cent. more than in the *Mississippi*. The draft of water and dip of the wheels was not noted on any of the logs, which prevents our knowing the displacement of the vessels; it is however probable, that all of them drew the average on sea service, and, therefore, that the comparison of their performance is a fair one. M.

For the Journal of the Franklin Institute.

Experiments on the Paddle Wheels of the U. S. Steam Frigate "Mississippi," to Determine the Influence Exerted on their Slip by the Omission of every other Paddle. By B. F. Isherwood, Chf. Eng. U. S. N.

During the Mediterranean cruise of the U. S. steam frigate "*Mississippi*," in the years 1849, 1850, and 1851, an experiment was made by her chief engineer, Jesse E. Gray, U. S. N., to determine the influence on the slip of her paddle wheels by the omission of every other paddle.

The "*Mississippi*" had occasion, in the course of this cruise, to make a number of short passages between Spezzia and Leghorn, along "the tideless shores of the Mediterranean," a distance of 37½ geographical miles of 6085 feet. These passages were all made in fine weather with light airs and smooth sea. The results were reasonably uniform; the vessel's draft of water and the immersion of the paddles not varying enough throughout to sensibly affect them. The mean of eight passages, made with the full number of twenty-one paddles in each wheel, the total number of revolutions made by the wheels being taken by a counter, gives accurate data for the slip with the paddle wheels in their normal condition. After seven passages had been thus made, with considerable intervals of time between them, every other paddle was removed, reducing the number to eleven in each wheel in place of twenty-one, necessarily leaving two in their original juxtaposition from the odd (21) number of the original paddles. One passage was made with the paddles in this condition with weather quite as fine and under circumstances quite as favorable as before; the total number of revolutions made by the wheels was ascertained by the counter as before. This last performance was not repeated from prudential motives, for the concussion and shock on the water of the entering paddles, now that they were removed so far apart, produced so excessive a vibration and shaking of every part of the vessel as to be very uncomfortable to the persons on board:—the paddles struck the water as though it were a solid rather than a fluid substance. And this was the more remarkable, because with the twenty-one paddles in each wheel not the slightest vibration of the hull had ever been experienced from the action of the machinery; the "*Mississippi*" being noted for solidity and steadiness. The alternate paddles were now restored, and during the last passage between the same points and under the same conditions of weather, &c., as before, the first results were again obtained; the vibration and shaking of the hull and the violent

concussions of the entering paddles on the water, entirely ceased with the restoration of the original paddle surface.

During these experiments the vessel's mean draft of water averaged 18 feet 11 inches. The paddle wheels were 29 feet diameter from outside to outside of paddles—the paddles were 11 feet in length by 22 inches in width. For further details and dimensions of the "*Mississippi*," see Vol. xxiv. of this Journal, p. 384. The following are the dates of the passages, together with the total number of revolutions made during each passage by the paddle wheels—this number was taken by a counter receiving its motion from the engines. The time of making the passages, steam pressures, &c., though not observed with precision, were about the same throughout.

Date.	Passage.	Number of revolutions made by the paddle wheels as taken by the counter.
	Steaming with 21 *Paddles in each Wheel.*	
September 10, 1849,	From Leghorn to Spezzia, . .	3170
November 17, "	" Spezzia to Leghorn, .	2920
" 25, "	" Leghorn to Spezzia, . .	2940
" 27, "	" Spezzia to Leghorn, .	3050
April 23, "	" " " " . .	2960
October 14, 1850,	" " " " . .	3050
" 19, "	" Leghorn to Spezzia, . .	2980
May 31, 1851,	" " " " . .	3020
	Mean of the eight passages, .	3011
	Steaming with 11 *Paddles in each Wheel.*	
April 19, 1851,	From Leghorn to Spezzia, . .	3536

With the above data, making the calculations for the slip of the centre of pressure of the paddles, we obtain the following results, viz:

Slip when steaming with 21 paddles in each wheel, 12·79 per centum.
" " " 11 " " 25·74 " "

From the above it will be perceived, that halving the number of paddles in each wheel by the omission of every other one, just doubled the slip. But few readers will probably have expected such a result, as the prevailing opinion is that such an omission of paddles would affect the slip to only an inconsiderable degree. But beside the incontestible evidence of the self-registering counter, there is the strongly marked effect produced upon the heavy and solid live oak hull. With 21 paddles in each wheel, the paddles at their periphery were 4·338 feet from centre to centre; with 11 paddles in each wheel, they were 8·676 feet from centre to centre; this latter distance seems great enough to enable an intermediate paddle to act with full effect without enfeeblement from the adjacent ones. The entering paddle struck the water at an angle of 57° from the perpendicular, making the angle included between the paddle and water level 33° only. Under these conditions, the mean

loss of useful effect by the oblique action of the paddles on the water, calculated for every 10° and as the squares of the series of their angles of incidence on the water, was 25·77 per centum of the power applied to them.

For the Journal of the Franklin Institute.

Steam Blow-Pipes. By R. J. Nunn, M. D., Savannah, Ga.

In No. 41 *Scientific American*, mention is made of a furnace for chemical analysis, lately patented in England. Some years ago in a laboratory, which was at that time in my possession, there were several plans in operation for using steam to supply the place of the table blow-pipe. They were convenient, and capable of producing a very high temperature. As perhaps some of your readers may be interested in the use of such an instrument, a description of the most useful of them may be acceptable.

As at times, gas could not be procured, alcohol was sometimes used, but the expense of this fluid prevented its employment on all occasions, so that when coal gas was not obtainable, oil or tallow was occasionally brought into requisition; for these reasons, a burner was provided for each, which were all adaptable to the same boiler; the furnace in which gas was employed, involved precisely the same principle as that claimed by the English patentee.

The boiler was a copper vessel, capable of holding about four gallons, (a part of a distilling apparatus;) a supply pipe descended within, and at one side to about an inch from the bottom, and projected about two inches above the vessel, terminating in a stop-cock, to which was attached about five feet of vulcanized india-rubber tube; a glass tube placed vertically on outside, one extremity of which was on a level, and communicated with the bottom, while the other rose to the same height, and was connected with the top of the vessel, served to indicate the height of the water in the interior; a safety valve and steam pipe completed the arrangement. The safety valve which was first used, consisted of a glass tube bent at two right angles, so that while one extremity was connected with the top of the boiler, the other dipped into a cup of mercury, by varying the depth to which the tube descended in the quicksilver; the pressure was increased or diminished at pleasure; subsequently a valve of the usual construction was employed.

The burner used with gas, was one belonging to an oxyhydrogen blow-pipe, the steam passing through the oxygen jet, and the gas entering the one used for hydrogen.

When volatile liquids were more convenient, the steam before escaping at the jet, was made to heat the chamber containing the wick, and the vapor thus obtained was used as gas. When the burner was at a distance from the fluid, it was found convenient to keep the steam and gas pipes in contact, and, furthermore, to envelop them in some non-conducting material, to prevent condensation.

When oil was employed, a jet of steam was made to issue from the

centre of the wick. In all cases it was found more serviceable to have the steam jet in the centre of the flame.

To set the apparatus in action, the boiler was first half filled with water, (the height being determined by the glass tube,) which being made to boil, the pressure was regulated to the required degree; the supply pipe was next maintained in a perpendicular position, and a stream of water sufficient to equal the evaporation, was admitted by the stop-cock, (if a pressure more than two pounds per square inch, was at any time desired, the supply pipe was of course proportionately lengthened;) the gas was then lit, and finally, the steam let on. By regulating the proportions between the pressure, the supply of steam, and that of gas, any desired variation could be obtained.

When fluids, (such as alcohol, naphtha, &c.,) were used, the steam was allowed to pass through the jet a few moments, to cause some evaporation; it was then stopped off, the vapor ignited, and the steam again let on. The burner had to be kept above the level of the boiler, otherwise the condensed steam accumulated and interfered with the steadiness of the blast.

It is to be hoped, our chemical instrument makers will manufacture some apparatus on this principle, as it is exceedingly convenient, and can be made in connexion with the still-body, like the one just described; arrangements should also be supplied suitable to each kind of burning material.

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*On the Construction and Proper Proportions of Boilers for the Generation of Steam.** By Andrew Murray, Chf. Eng. of Her Majesty's Dock Yard, Portsmouth.

Mr. Muir, in his paper on the Smoke Nuisance, read before the Society on the 17th of January, referred, and other parties have done the same, to a want of definite rules for the relative dimensions for the flues and other parts of steam engine boilers. In 1844, in a paper read before the Institution of Civil Engineers, Mr. Andrew Murray gave the results which he had arrived at, on these points, after long observation and much consideration. As his experience since 1844 has confirmed him in the opinions then expressed, he has enclosed to the secretary a copy of the paper, from which the following extracts are taken.

"The supply of the requisite quantity of air to the fuel on the bars, being of the utmost importance, it is usual to make the ash-pit, and the entrance to it, as large, and as free, as the situation will allow. In marine boilers, or wherever it is necessary to limit the size of the ash-pit, the area for the entrance of the air into it, should never be less than one-fourth part of the area of the grate, and in order to facilitate the supply to the back part of the grate, the bars should be made to incline downwards to the extent of about one inch in a foot. No advantageous results will be obtained from increasing the ash-pit, as is sometimes done in land boilers, to a very great extent, by making it 5 or 6 feet deep; about 2½ feet is sufficiently deep, even supposing that the ashes are not cleared out oftener than once a day.

*From the Journal of the Society of Arts, February, 1855.

"The extent of "dead plate" in front of the furnace is not material, as respects combustion; in marine boilers, it is generally not more than about 6 inches broad, which is the width of the water space between the fire and the front of the boiler; but in land boilers it is frequently required to be very broad, to support the brick-work, especially in those cases where the flue is carried across the front.

"The amount of the opening between the bars, should be about $\frac{7}{16}$ths of an inch, but this must be regulated by the kind of coal to be burnt upon them; but for any kind of coal, it should not be less than $\frac{3}{8}$ths of an inch, nor more than $\frac{1}{2}$ an inch. If the space were made larger, the waste from the amount of cinders, or of small pieces of coke, which would fall through in a state of incandescence, would be considerable; otherwise it would be preferable to have a larger space. In order to facilitate the supply of air, each bar should be as thin as is consistent with the strength required. The bars in general use in this country, are 1 inch or $1\frac{1}{8}$ inch in thickness, but it would be much more advantageous to use them thinner, as in France, where they are frequently used not more than $\frac{1}{2}$ inch thick.

"The advantage of a considerable amount of space in the furnace, over the fire-bars, has been already mentioned, but no very decisive experiments have been made on this subject. Three cubic feet of space to each superficial foot of grate bar surface, may be stated as a good proportion where there is nothing to prevent this amount being obtained. When the space is reduced below one foot and a half to each foot of grate, it will be found to be attended with a marked disadvantage.

"The area of the flue, and subsequently of the chimney through which the products of combustion must pass off, must be regulated by their bulk and their velocity. The quantity of air chemically required for the combustion of one pound of coal, has been shown to be 150·35 cubic feet, of which 44·64 enter into combination with the gases, and 105·71 with the solid portion of the coal. From the chemical changes which take place in the combination of the hydrogen with oxygen, the bulk of the products is found to be to the bulk of the atmospheric air required to furnish the oxygen, as 10 is to 11. The amount is therefore 49·104. This is without taking into account the augmentation of the bulk due to the increase of the temperature. In the combination which takes place between the carbon and the oxygen, the resultant gases (carbonic acid gas and nitrogen gas) are of exactly the same bulk as the amount of air, that is, 105·71 cubic feet, exclusive, as before, of the augmentation of bulk from the increase of temperature. The total amount of the products of combustion in a cool state would therefore be

$$49{\cdot}104+105{\cdot}71=154{\cdot}814 \text{ cubic feet.}$$

"The general temperature of a furnace has not been very satisfactorily ascertained, but it may be stated at about 1000° Fahrenheit, and at this temperature, the products of combustion would be increased, according to the laws of the expansion of aeriform bodies, to about three times their original bulk. The bulk, therefore, of the products of combustion which must pass off, must be $154{\cdot}814\times3=464{\cdot}442$ cubic feet. At a velocity of 36 feet per second, the area, to allow this quantity to pass off in an hour, is ·516 square inch. In a furnace in which 13 lbs. of coal

are burnt on a square foot of grate per hour, the area to every foot of grate would be $\cdot 516 \times 13 = 6 \cdot 708$ square inches; and the proportion to each foot of grate, if the rate of combustion be higher or lower than 13 lbs., may be found in the same way.

"This area having been obtained, on the supposition that no more air is admitted than the quantity chemically required, and that the combustion is complete and perfect in the furnace, it is evident that this area must be much increased in practice, where we know these conditions are not fulfilled, but that a large surplus quantity of air is always admitted. A limit is thus found for the area over the bridge, or the area of the flue immediately behind the furnace, below which it must not be decreased, or the due quantity could not pass off, and consequently the due quantity of air could not enter, and the combustion would be proportionally imperfect. It will be found advantageous in practice to make the area 2 square inches instead of ·516 of a square inch. The imperfection of the combustion in any furnace, when it is less than 1·5 square inch, will be rendered very apparent by the quantity of carbon which will rise unconsumed along with the hydrogen gas, and show itself in a dense black smoke on issuing from the chimney. This would give 26 square inches of area over the bridge to every square foot of grate, in a furnace in which the rate of combustion is 13 lbs. of coal on each square foot per hour, and so in proportion for any other rate. Taking this area as the proportion for the products of combustion, immediately on their leaving the furnace, it may be gradually reduced, as it approaches the chimney, on account of the reduction in the temperature, and consequently in the bulk of the gases. Care must, however, be taken that the flues are nowhere so contracted, nor so constructed as to cause, by awkward bends, or in any other way, any obstruction to the draft, otherwise similar bad consequences will ensue.

"An idea is very prevalent that it is advantageous to make the flame or hot gases (as they may be termed, because we may look upon flame merely as a stream of gases heated to incandescence) impinge upon, or strike forcibly the plates of a boiler, at any bend or change of direction in the flue. The turn in the flue is, therefore, made with a square end, and with square corners; but it is difficult to see on what rational grounds the idea of advantage can be upheld. The gases, if they are already in contact with the plate, cannot be brought closer to it, and any such violent action is not necessary to alter the arrangement of the particles of the gases and bring the hotter particles to the outside; while there is a great risk of an eddy being formed and of the gases being thrown back and returned upon themselves, when they strike the flat opposing surface; thus impeding the draft and injuring the performance of the boiler. That circulation will take place to a very great extent, among the particles of heated gases, flowing in a stream even in a straight flue, will be apparent from those particles next the surface being retarded, by the friction against the sides and by their tendency to sink into a lower position in the stream, from their having been cooled down and become more dense. An easy curve is sufficient to cause great change in the arrangement of the particles, as those which are towards the outside of the bend, have a much longer course to travel, and are thus retarded in comparison with

the others. From these causes the hotter particles in the centre of the flowing mass, are in their turn brought to the outer surface and made to give out their heat. The worm of a still is never found returning upon itself with square turns, as if the vapor inside would be more rapidly cooled by its impinging on the opposite surface; yet the best form of worm is a subject which has engaged the attention of many able men, and therefore may well be taken by engineers as a guide in the management of a similar process, though carried on at a much higher temperature.

"Another very prevalent practice and which also would seem to be open to serious objections, is, that the flues are frequently made of much greater area in one part than in another. This arises from a desire to obtain a larger amount of heating surface, than is consistent with the proper area of the flue, or with the amount of the heated gases which are passing through it. The flue is thus made shorter in its course than it ought to be in proportion to its sectional area. This is even sometimes done, by placing a plate of iron partly across the flue, near the bottom of the chimney, thus suddenly contracting the passage for the gases. The effect of this is evidently to cause a very slow and languid current, in the larger part of the flue, and the consequence is, that a deposition of soot rapidly takes place there. In many marine and land boilers, having one internal flue in them, of too large a size, this will be found to be the case, soot being soon deposited, till the flue is so filled up that the area left is only such as is due to the quantity of heated gases passing though it; the value of those parts of the sides of the flue which are covered with soot is thus lost. * * * * *

"When the gases have reached the foot of the chimney, in a well-proportioned boiler, they will be found to be reduced to a temperature of about 500° Fahrenheit, or below it; their bulk will, in consequence, be reduced by about $\frac{1}{3}$d below their bulk on their first leaving the furnace. The reduction in the area of the flue, ought not to be in the same proportion, because their velocity is no longer so great. The reduction ought to be made gradually, as has been stated before, and not by a sudden contraction at the foot of the chimney; as the effect of this is to cause a slowness of draft in the latter part of the flue and consequently a deposition of soot; and then the surface, so covered, which had been reckoned upon as effective heating surface, is lost. The area of a chimney to allow the products of the combustion of each pound of coal consumed in an hour, to pass off, should be not less than $\frac{3}{4}$ths of 2 square inches, this latter being the area given for the flue, immediately behind the fire-place—that is, $1\frac{1}{2}$ square inch; and for a boiler burning 13 lbs. of coal per hour on each superficial foot of its grate, the area should be $\frac{3}{4}$ths of 26 square inches, or $19\frac{1}{2}$ square inches.

"Theoretical research not having as yet given us any valuable assistance, in determining the proper height of a chimney, we must again refer to practice as our guide. A good draft may be obtained with a very low chimney, but at a great expenditure of fuel, from the necessity that exists in such a case for allowing the gases to pass off at a much higher temperature than would otherwise be necessary. For a chimney built of brick-work, the height ought not to be less than 20 yards, and may be in-

creased to 30 yards or 40 yards, with advantage in the economy of fuel. When chimneys are carried to a still greater height, it is generally for the purpose of carrying off the smoke, or any deleterious gases, from the immediate neighbourhood, or to create a good draft with gases at a lower temperature, than those from a steam-boiler furnace. On board steam vessels chimneys are limited in their height by the size of the ship, on account of the influence the chimney has on the stability and appearance. It will generally be found advantageous to make the chimney as high as these circumstances will permit."

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*Tempering of Steel.**

In the discussion on Mr. Sanderson's paper, "On the Manufacture of Steel," an inquiry was made as to the kind of steel suitable for particular articles, and how its quality might be tested. This gave rise to the remark that the tempering of steel depended on the skill and experience of the workman. Mr. Harry Scrivenor, of Liverpool, has, however, obtained from a clever workman the following memoranda on the subject:—

"I received your letter inquiring what steel was best for different kinds of manufactures. I should say cast steel, if it can be applied; double shear for hatchets, or any kind of edge tool that cannot be well made of cast steel. The temper to be as follows:—

"1st. For boring cylinders, turning rolls, or any large cast iron, let it be as hard as water will make it, minding not to heat it more than a cherry red.

	Deg. Fahr.
2d. Tools for turning wrought iron, pale straw color,	430
3d. Small tools for ditto, shade of darker yellow,	450
4th. Tools for wood, a shade darker,	470
5th. Tools for screw taps, &c., still darker straw color,	490
6th. For hatchets, chipping chisels, brown yellow,	500
7th. For small rimers, &c., yellow, slightly tinged with purple,	520
8th. For shears, light purple,	530
9th. For springs, swords, &c., dark purple,	550
10th. For fine saws, daggers, &c., dark blue,	570
11th. For hand and pit saws &c., pale blue,	590

"The temper greatly depends on the quantity of carbon that is in the steel—this, the practical man soon finds out, and he tempers or draws down his tool accordingly."

Earth-Boring Machinery.†

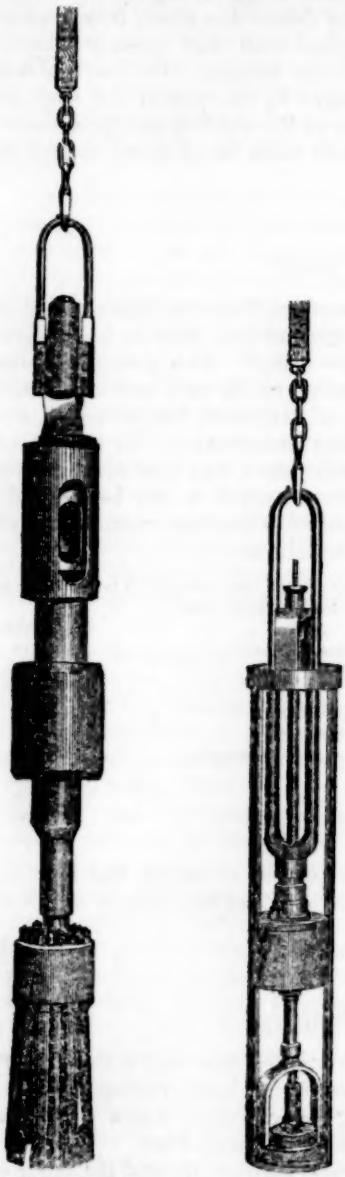
A paper on this subject by Mr. Colin Mather, was read at the Society of Arts on the 30th May, 1855, in the course of which various modes of boring artesian wells were described, and especially a new plan now being brought into operation by Messrs. Mather and Platt.

The construction of the boring head and shell pump, and the mode of acquiring the percussive motion, constitute the chief novelties of the system and machine. The couple cylinder engine, with the reversing

* From the Lond. Journal of the Society of Arts, May, 1855.

† From the Lond. Builder, No. 644.

or link motion, is used for winding and lowering apparatus, but an ordinary winding engine, similar to those used in collieries, may be applied.



BORING HEAD. SHELL PUMP.

The boring head consists of a wrought iron bar, about 8 feet long, on the lower part of which is fitted a block of cast iron, in which the chisels or cutters are firmly secured. Above the chisels an iron casting is fixed to the bar, by which the boring head is kept steady and perpendicular in the hole. A mechanical arrangement is provided, by which the boring head is compelled to move round a part of a revolution at each stroke. The loop or link by which the boring apparatus is attached to the rope is secured to a loose casting on the wrought iron bar, with liberty to move up and down about 6 inches. A part of this casting is of square section, but twisted about one-fourth of the circumference. This twisted part moves through a socket of corresponding form on the upper part of a box, in which is placed a series of ratchets and catches, by which the rotary motion is produced. Two objects are here accomplished—one the rotary motion given to the boring head, the other a facility for the rope to descend after the boring head has struck, and so prevent any slack taking place, which would cause the rope to dangle against the side of the hole, and become seriously injured by chafing.

The shell-pump is a cylinder of cast iron, to the top of which is attached a wrought iron guide. The cylinder is fitted with a bucket similar to that of a common lifting-pump, with an india rubber valve. At the bottom of the cylinder is a clack, which also acts on the same principle as that in a common lifting-pump, but it is slightly modified to suit the particular purpose to which it is here applied. The bottom clack is not fastened to the cylinder, but works in a frame attached to a rod which passes through the bucket, and through a wrought iron guide at the top of the cylinder, and is kept in

its place by a cotter, which passes through a proper slot at the top of the rod. The pump-rod, or that by which the bucket is worked, is made of a forked form, for the two-fold purpose of allowing the rod to which the bottom clack is attached to pass through the bucket, and also to serve as the link or loop by which the whole is suspended.

The wrought iron guide is secured to the top of the cylinder, and prevents the bucket from being drawn out when the whole is so suspended. The bottom clack also is so arranged that it is at liberty to rise about six inches from its seating, so as to allow large fragments of rock, or other material, to have free access to the interior of the cylinder when a partial vacuum is formed there by the up stroke of the pump.

The percussive motion is produced by means of a steam cylinder, which is fitted with a piston of 15 inches diameter, having a rod of cast iron 7 inches square branching off to a fork, in which is a pulley of about 3 feet in diameter, of sufficient breadth for the rope to pass over, and with flanches to keep it in its place. As the boring head and piston will both fall by their own weight when the steam is shut off, and the exhaust valve opened, the steam is admitted only at the bottom of the cylinder: the exhaust port is a few inches higher than the steam port, so that there is always an elastic cushion of steam of that thickness for the piston to fall upon.

The valves are opened and shut by a self-acting motion derived from the action of the piston itself, and as it is of course necessary that motion should be given to it before such a result can ensue, a small jet of steam is allowed to be constantly blowing into the bottom of the cylinder: this causes the piston to move slowly at first, so as to take up the rope, and allow it to receive the weight of the boring rod by degrees, and without a jerk. An arm which is attached to the piston-rod then comes in contact with a cam, which opens the steam-valve, and the piston moves quickly to the top of the stroke. Another cam, worked by the same arm, then shuts off the steam, and the exhaust valve is opened by a corresponding arrangement on the other side of the piston-rod. By moving the cams the length of the stroke can be varied at the will of the operator, according to the material to be bored through. The fall of the boring head and piston can also be regulated by a weighted valve on the exhaust pipe, so as to descend slowly or quickly, as may be required.

The general arrangement of the new machine may be described as follows:—

The winding drum is 10 feet in diameter, and is capable of holding 3000 feet of rope, 4½ inches broad and half an inch thick: from the drum the rope passes under a guide pulley, through a clam and over the pulley which is supported on the fork end of the piston-rod, and so to the end which receives the boring head, which being hooked on and lowered to the bottom, the rope is gripped by the clam. A small jet of steam is then turned on, causing the piston to rise slowly until the arm moves the clam, and gives the full charge of steam: an accelerated motion is then given to the piston, raising the boring head the required height, when the steam is shut off, and the exhaust opened in the way described, thus effecting one stroke of the boring head as regulated by a back pressure valve in the exhaust pipe. The exhaust port is 6 inches

from the bottom of the cylinder: when the piston descends to this point it rests on a cushion of steam, which prevents any concussion. To increase the lift of the boring head or compensate for the elasticity of the rope, which is found to be 1 inch in 100 feet, it is simply necessary to raise the cams on the cam shaft whilst the percussive motion is in operation. The clam which grips the rope is fixed to a slide and screw, by which means the rope can be given out as required. When this operation is completed, and the strata cut up by a succession of strokes thus effected, the steam is shut off from the percussive cylinder, the rope unclamped, the winding engine put in motion, and the boring head brought up and slung from an overhead suspension bar by a hook fitted with a roller to traverse the bar. The shell pump is then lowered, the *débris* pumped into it, by lowering and raising the bucket about three times, which the reversing motion of the winding engine readily admits of. It is then brought to the surface and emptied by the following very simple arrangement. At a point in the suspension bar a hook is fixed perpendicularly over a small table in the waste tank, which table is raised and lowered by a screw. The pump being suspended from the hook hangs directly over the table, which is then raised by the screw till it receives the weight of the pump. A cotter, which keeps the clack in its place, is then knocked out, and the table screwed down. The bottom clack and the frame descending with it, the contents of the pump are washed out by the rush of water contained in the pump cylinder. The table is again raised by the screw, and the clack resumes its proper position: the cotter is then driven into the slot, and the pump is again ready to be lowered into the hole as before. It is generally necessary for the pump to descend three times in order to remove all the *débris* broken up by the boring head at one operation.

The following facts, obtained from the use of the machine in boring in the new red sandstone at Manchester, will show its actual performance, and enable us to compare it with the other systems mentioned in this paper. The boring head is lowered at the rate of 500 feet a minute: the percussive motion is performed at the rate of twenty-four blows a minute; and, being continued for ten minutes, the cutters in that time penetrate from 5 to 6 inches: it is then wound up at 300 feet a minute. The shell pump is then lowered at the rate of 500 feet a minute, the pumping continued for one minute and a half, and being charged, the pump is wound up at 300 feet a minute. It is then emptied, and the operation repeated, which can be accomplished three times in ten minutes, at a depth of 200 feet. The whole of one operation, resulting in the deepening of the hole 5 to 6 inches, and cleansing it of the *débris* ready for the cutters or boring head being again introduced, is seen to occupy an interval of twenty minutes only. The value of these facts will be best shown by comparing them with the results by the old method.

At Highgate the boring has occupied two years in attaining a depth of 680 feet from the bottom of a well 500 feet deep from the surface. Their progress at present is at the rate of 6 inches per week, working night and day. At Warwick, thirteen months were occupied in boring 400 feet through red marl; at Saltaire, two years in going 80 yards.

Some of the more important public uses to which the new machine can be applied may now be briefly enumerated.

Sanitary questions deservedly occupy at the present time a large share of public attention. Water, as is well known, is the chief agent in sanitary reform. It is necessary for flushing sewers, for supplying baths and wash-houses, as well as for meeting the domestic wants of all classes of the community. The importance of cleanliness cannot be overrated, as a means of promoting the general health, and it imposes the necessity for a much more copious supply of pure water than is as yet enjoyed in most towns. Many small towns which are so situated that they cannot command a supply of water from natural sources, are prevented from obtaining it by boring, on account of the great expense, and still more the vexatious uncertainty of the process. The corporation of Manchester have expended upwards of a million sterling in supplying that city and its neighborhood with water, and they sell it to the corporation of Salford at the rate of three pence per thousand gallons. It is confidently believed that by the new method of boring, an abundant supply of water could be procured on the spot at half that price. Thus, in a sanitary point of view, the new machine is of the utmost value, since it enables us to procure a much greater supply of water in far less time, and from depths which were all but inaccessible on the old method of boring. For example, the work at Highgate, which has occupied two years, could have been done in thirty-three days. That at Warwick, which has occupied thirteen months, could have been done in twenty days. That at Saltaire, to supply the work-people with drinking water, which has occupied two years, could have been done in twenty-nine days.

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*On the Manufacture of Steel.**

A paper on the manufacture of steel, as carried on in different countries, was read on Wednesday evening, May 9, at the Society of Arts, by Mr. Charles Sanderson. After alluding to the antiquity of the manufacture, the composition of steel, and the raw materials from which it is prepared, the author proceeds as follows:

The kinds of steel which are manufactured are natural steel, called raw steel, or German steel; Paal steel produced in Styria, by a peculiar method; cemented, or converted steel; cast steel, obtained by melting cemented steel; puddled steel, obtained by puddling pig iron in a peculiar way.

Natural, or German steel, is so called because it is produced direct from pig iron, the result of the fusion of the spathose iron ores alone, or in a small degree mixed with the brown oxide; these ores produce a highly crystalline metal, called *spiegel eisen*, that is, looking-glass iron, on account of the very large crystals the metal presents. This crude iron contains about four per cent. of carbon, and four to five per cent. of manganese. Karsten, Hassenfratz, Marcher, and Reamur, all advocate the use of grey pig iron for the production of steel; indeed, they state distinctly that first quality steel *cannot* be produced without it; that the object is

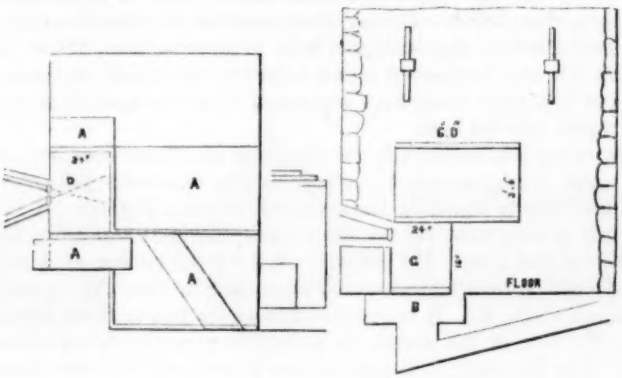
* From the Lond. Mechanics' Mag., May, 1855.

to clear away all foreign matter by working it in the furnace, to retain the carbon, and to combine it with the iron. This theory I hold to be incorrect, although supported by such high authorities. Grey iron contains the maximum quantity of carbon, and, consequently, remains for a longer time in a state of fluidity than iron containing less carbon; the metal is then mixed up, not only with the foreign matter it may itself contain, but also with that with which it may become mixed in the furnace in which it is worked. This prolonged working, which is necessary to bring highly carbonized iron into a malleable state, increases the tendency to produce silicates of iron, which entering into composition with the steel during its production, renders it red short. Again, by the lengthened process, the metal becomes very tender and open in its grain; the molecules of silicate of iron which are produced will not unite with the true metallic part; and also, whenever the molecular construction of iron or steel is destroyed by excessive heat, it becomes unmalleable. Both these are the causes of red shortness, and also of the want of strength when cold. For these reasons I consider that grey pig iron is by no means the best for producing natural steel; and for the same reasons I should not recommend the highly carbonized white iron, although it is now used both in Germany and in France. In Austria, however, they have improved upon the general continental process; their pig iron is often highly carbonized, but they tap the metal from the blast furnace into a round hole, and throwing a little water on the surface, they thus chill a small cake about half an inch; this is taken from the surface, and the same operation is performed until the whole is formed into cakes; these cakes are then piled edgewise in a furnace, are covered with charcoal, and heated for 48 hours; by this process the *carbon* is very much discharged. By using these cakes in the refining, the steel is sooner made, and is of better quality. In the opinions I have given to many German steel makers, and in the advice I have offered them, I have endeavored to show that pig iron can only be freed from its impurities whilst in a fluid state. I take the advantage of the property of cast-iron, and previous to melting it in the steel refinery I submit it to a purification, by which process I seek to *reduce* the degree of carbonization of the metal, and to separate and dissolve the earthy matter with which it may be combined; I then obtain a purer metal for the production of steel. The metal itself being to some extent decarbonized, is sooner brought into "nature," as it is termed, that is, it sooner becomes steel. The process being shorter, and the metal itself being purer, there is less chance or opportunity for the formation of deleterious compounds, which, becoming incorporated with the steel, seriously injure its quality. Of course, steel manufactured from crude iron, either purified or not, of any defined quality, will inherit such quality, be it good or bad. Art can, in some degree, remove these noxious qualities from the crude iron. Chemistry has lent its powerful assistance, yet nature will maintain her sway, and in all cases the good or bad qualities of the metal will be transmitted to the steel.

The furnaces in which raw or natural steel is manufactured are nearly the same, as far as regards their general construction, in all countries where such steel is produced; yet each country, or even district, has the fire in which the metal is worked differently constructed. We find, there-

fore, the German, the Styrian, the Corinthian, and many other methods, all producing steel from pig iron, yet pursuing different modes of operation. These differences arise from the nature of the pig the country produces, and the peculiar habits of the workmen. These modified processes do not affect the theory of the manufacture, but they rather accommodate themselves to the peculiar character of the metal produced in the vicinity. In Siegen they use the white carbonized, manganesian metal, while in Austria a grey or mottled pig iron is used.

Fig. 1. Fig. 2.



The furnace is built in the same form as a common charcoal refinery.

Fig. 1 shows a ground-plan of the furnace; fig. 2 an elevation; and fig. 3 the form of the fire itself and the position of the metal within it.

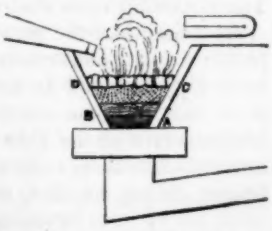
The fire, D, is 24 inches long and 24 inches wide; A, A, A, are metal plates surrounding the furnace.

Fig. 2 shows the elevation usually built of stone, and braced with iron bars. The fire, G, is 16 inches deep and 24 inches wide. Before the tuyere at B, a space is left under the fire, to allow the damp to escape, and thus keep the bottom dry and hot.

In fig. 1 there are two tuyeres, but only one tuyere iron which receives both the blast nozzles, which are so laid and directed that the currents of air cross each other, as shown by the dotted lines; the blast is kept as regular as possible, so that the fire may be of one uniform heat, whatever intensity may be required.

Fig. 3 shows the fire itself, with the metal, charcoal, and blast. A is a bottom of charcoal, rammed down very close and hard. B is another bottom, but not so closely beaten down; this bed of charcoal protects the under one, and serves also to give out carbon to the loop of steel during its production. C is a thin stratum of metal, which is kept in the fire to surround the loop. D shows the loop itself in progress. When the fire is hot, the first operation is to melt down a portion of pig iron, say 50 to 70 pounds, according as the pig contains more or less carbon; the charcoal is then

Fig. 3.



pushed back from the upper part of the fire, and the blast, which is then reduced, is allowed to play upon the surface of the metal, adding from time to time some hammer slack, or rich cinder, the result of the previous loop. All these operations tend to *decarbonize* the metal to a certain extent; the mass begins to thicken, and at length becomes solid. The workman then draws together the charcoal and melts down another portion of metal upon the cake. This operation renders the face of the cake again fluid, but the operation of decarbonization being repeated in the second charge, it also thickens, incorporates itself with the previous cake, and the whole becomes hard; metal is again added until the loop is completed. During these successive operations the loop is never raised before the blast, as it is in making iron, but it is drawn from the fire and hammered into a large bloom, which is cut into several pieces, the ends being kept separated from the middle or more solid parts, which are the best.

This operation, apparently so simple in itself, requires both skill and care. The workman has to judge, as the operation proceeds, of the amount of carbon which he has retained from the pig iron; if too much, the result is very raw, crude, untreatable steel; if too little, he obtains only a steelified iron. He has also to keep the cinder at a proper degree of fluidity, which is modified from time to time by the addition of quartz, old slags, &c. It is usual to keep from two to three inches of cinder on the face of the metal, to protect it from the direct action of the blast. The fire itself is formed of iron plates, and the two charcoal bottoms rise to within nine inches of the tuyere, which is laid flatter than when iron is being made. The position of the tuyere causes the fire to work more slowly, but it insures a better result.

The quantity of blast required is about 180 cubic feet per minute, at a pressure of 17 inches water gauge. Good workmen make 7 cwt. of steel in 17 hours. The waste of the pig iron is from 20 to 25 per cent., and the quantity of charcoal consumed is 240 bushels per ton. The inclination of the tuyere is 12 to 15 degrees. The flame of the fire is the best guide for the workmen. During its working it should be a red blueish color. When it becomes white the fire is working too hot.

(To be Continued.)

On a new Manufacture of Compound Metallic Rods and Bars.

A paper on the above subject was recently read at the Institution of Mechanical Engineers, Birmingham, by Mr. E. J Payne, of that place. The following is an abstract of the author's remarks:

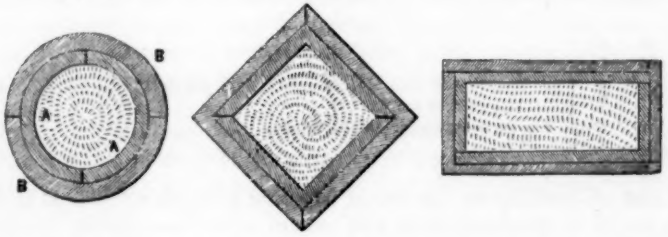
At a time like the present, when the high price of iron is of such importance to the consumers of rods and bars, descriptions of iron very extensively employed in many of the staple trades of this neighborhood, there may be some interest attached to the result of some experiments lately made with the view of producing an economical substitute for solid iron rods and bars, such as are mainly employed in the manufacture of fences, railing, hurdles, metallic bedsteads, and many other purposes.

* From the Lond. Mech. Mag., May, 1855.

The specimens exhibited, though somewhat crude, serve to elucidate the principle of the process.

They are small samples cut from lengths of rods and bars rolled in the following manner:—Two skelps of iron, A A, of the requisite weight, previously ascertained, are placed together to form a cylinder; and two similar skelps, B B, but of a somewhat larger size, are laid round this cylinder in such a manner as to break or cross the joints, as shown in fig. 1. The whole is then bound together with iron hoops or strong wire, and a short piece of solid metal driven into one end of this cylinder, which is then filled with sand, earth, or ashes, and well and tightly rammed and dried, after which the open end is plugged in the same way as the opposite one had been.

Fig. 1. Fig. 2. Fig. 3.



The billet thus charged is put in the furnace, and when at a sufficient heat is removed to the rolls, and rolled out precisely as solid iron, the sand core being reduced in very nearly the same proportion as the iron.

The exactness of this proportion depends entirely upon the thorough ramming of the core in the billet; for if the sand be loose, it follows that by the compression of the core in rolling, the iron makes up the deficiency in diameter, and a shorter length of rod than the billet was calculated to make is the result. Some of the specimens show this result clearly.

The area of sand in one of the billets shown, was one of iron to one of sand, or half sand, but after rolling and reducing it, it was found to have assumed the proportion of one and a half iron to one of sand, or only two-fifths sand.

It will be perceived by the specimens, that the sand during the process has become, by the heat and great pressure, a semivitreous body of exceeding hardness, so close in its texture as to bear a polish; and this appears to add (in conjunction with the tubular form of the metallic portion of the rod) very great additional strength;—for upon testing one of the specimens, about five-eighths of an inch in diameter, against a length of solid iron rod of the same diameter, by placing both upon benches, and suspending weights from the centre, the compound rod was found to sustain without deflexion a weight that nearly doubled up the solid rod.

Some of the rods produced, have been made from billets turned up into a cylinder from a flat skelp in gun barrel rolls, and one from the breech end of a twisted gun barrel; this was of course done merely as an experiment, as it appeared to be the worst description of tube for the purpose; the core, however, proved to be as sound as any of the rest. Gen-

erally speaking, the form of billet first described appears to be the best, and it is certainly the least expensive.

Thus far, the manufacture has been described of round rods. For square rods and flat bars, the same description of billet is employed, varying only in section; thus, for a square rod, a billet of the section, shown in fig. 2, composed of two skelps of a v form will be used; and for a flat bar, the section in fig. 3, made of skelps of angle iron would be employed, the operation of rolling being identical with that now in use for solid iron.

It now remains to show the result attained by these experiments, as to the saving of cost in the manufactured rod. The most complete estimate in the possession of the writer is one furnished from the works in South Wales, where the greater portion of these experiments have been made, which is the following:

Assuming the present price of the rolled skelps of the sections shown, to be

	£	s.	d.	
	9	10	0	per ton,
add	2	10	0	per ton, cost of making, ramming, and plugging the billets, including cost of sand.
add	1	0	0	per ton for contingencies and waste.
	£13	0	0	

Total cost of working up one ton of iron into a length equivalent to that which would be produced from two tons of solid iron; giving the price of the rods or bars containing half sand, 6*l.* 10*s.* per ton measurement, or a saving of about 3*l.* for the same length of rod or bar. But it should be remembered that these experiments have been confined to the production of rods not exceeding one inch in diameter, and that as the diameter of the rod increases, a considerably greater proportion of sand than one-half can be introduced: consequently a ton of iron may be made to produce more than two tons measurement of the larger rods or bars. This estimate of the saving on an average of all marketable sizes, would therefore be rather within the mark than otherwise.

Certain samples of railway rails upon the table were also rolled at the Cwm Avon works in South Wales, with a view of testing the applicability of the invention to effect a saving of metal in this branch of manufacture. Also, certain piles were made in the usual manner, with upper and lower plates of No. 2 iron, the remainder being puddled bars, and having a hollow in the centre, for the reception of the core; the sand was in this case first rammed in a core box, made of plate iron, $\frac{1}{4}$-inch thick. In one of these piles the core was $4\frac{1}{4}$ inches, the other, $3\frac{1}{4}$ inches square, but the ends were left unplugged; the result of the rolling showed that the sand assumed very much the form of the rail, but from the omission of the plugging, the area of the section of sand in the rails is not nearly so great in proportion as that of the one introduced in the pile.

Some samples of small copper tubes, made on the same principle as the iron rods, are also shown among the specimens, the only difference in their manufacture being, that the billets were in this case drawn cold; consequently, the sand not being vitrified, was readily removed afterwards from the bar, leaving it an open tube; but these may be more easily made by charging the billets (the cylinders for which are cast as shown by the

specimen exhibited) either of pure silica or plaster of paris, neither of which will vitrify, and then rolling them hot in the same manner as the iron rods. This kind of core undergoing no change by the action of the fire, may be bored out with ease.

Further experiments are now being made, with the endeavor to produce rods having a mere skin of iron on the strong core, the result of which the writer will be happy to communicate on a future occasion.

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*The High-Pressure Boilers of Her Majesty's Ship "Pembroke," of Sixty Guns.**

The accompanying drawings of the boilers of Her Majesty's Ship *Pembroke*, will, we trust, be acceptable to our readers. These boilers have been made by Messrs. Maudslay, Sons & Field, and are worthy of the high professional reputation of that firm.

Fig. 1, is a sectional elevation;
Fig. 2, a plan;
Fig. 3, a transverse section, across furnaces;
Fig. 4, a transverse section, showing arrangement of tube centres; and
Fig. 5, an end view of boilers, showing position occupied in the ship.

Length of tubes,		8′ 1″	
Diameter of tubes,		2 inches outside.	
Number of tubes,		864.	
Fire-grate surface,	120 ft.=		·6 per H.P.
Tube,	3654 ft.=	18·27	=19·87 per H. P.
Flue,	320 ft. =	1· 6	
Square inches in funnel,	1256 =		6· 3 per H. P.

While the universal public are denouncing in no measured terms, the bungling and blundering, which have been so awfully fatal to our small but brave army in the Crimea; and while there is a general feeling that professional men do not meet with that encouragement and success in

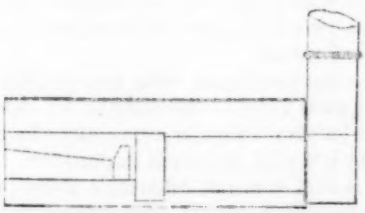


Fig. 1.—Sectional elevation.

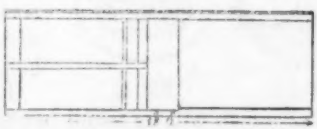


Fig. 2.—Plan. Scale $\frac{1}{8}$ = 1 foot.

the service of their country, when not backed and supported by other influences than those of *merit* and *fitness* alone (hence the introduction into the public service of so many bunglers); and while it is true that, as a whole, the public service has but seldom taken the lead in any great improvement in the practical application of science,—we do the more

* From the London Artizan, April, 1855.

cheerfully note that in so far as regards the introduction of high-pressure steam, the Steam Department of the Royal Navy deserves no small meed of praise, as taking the lead in a very important improvement in practical science.

There have been, with many of our engineers, of long standing and of high professional reputation, a dread of and a prejudice against the use of high-pressure steam; but its peculiar and valuable properties, when applied to the marine engine, are now so self-evident, that we feel quite confident that this dread and that prejudice will ere long be dispelled, and that it will become universal both in our Commercial as well as in our Royal Navy.

It is an old and trite saying, that necessity is the mother of invention. The immense value of steam-power in a ship-of-war was clearly developed in the Baltic campaign of last year, and, in anticipation of the work of the coming season, the Admiralty have converted about half-a-dozen old 74-gun sailing ships, in the course of a very few months, into good, useful steamships. The *Pembroke* is one of this class. She now carries 60 guns on two decks. The engines are simple, strong, and at the same time very compact, of 200 nominal horses power: the cylinders are 30 inches diameter; the length of stroke is 2 feet 6 inches. The boilers have been tested to 180 lbs. on the square inch; and if care be taken to make good pipes, good joints, and very simple boiler-mountings, we have every confidence that the results from the *Pembroke* will be very satisfactory indeed.

It will be observed that the tops of the boilers are considerably below the water-line, and it is just possible that these boilers may prime. If so, we would suggest that a steam-chest, or steam-reservoir, of say three feet diameter, should be placed athwart ship, on the top: it would also greatly simplify the boiler-mountings, and it would not interfere with the stowage of coal.

There is one objectionable feature which we would take leave to point out; namely, the length, 8 feet 1 inch, and the small diameter of the tubes, $1\frac{9}{16}$ through the ferrules. Until the blast-pipe is brought into play, the natural draft will be sluggish, and it will be a long time before *steam* can be *first* raised.

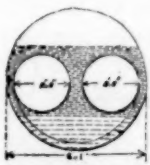


Fig. 3.

Fig. 4.

We can hardly see what can be gained by such a rigid adherence to the *style* of the locomotive boiler, especially where height is not of so much importance.

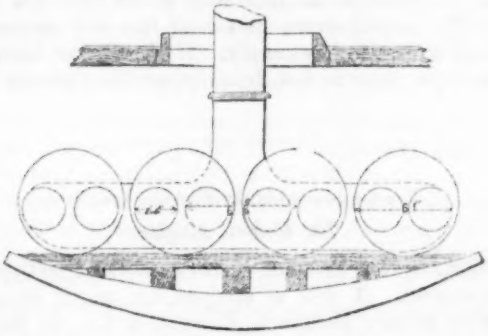
It is said that the *Malacca's* boiler (a sketch of which will be found in our January number), with tubes 6 feet long, gets steam very freely, and that there is also a good natural draft.

If the tubes of the *Pembroke* class had been $2\frac{1}{2}$ inches, and strong enough not to have required ferrules, and not longer than 6 feet, we can fancy that they would have been very successful and very useful marine boilers.

The exigencies of the war will not, we presume, afford time to enter into careful experiments with the machinery of these high-pressure steamships at present; but we will look forward with hopeful anticipation, and

trust that the Steam Department will give publicity to the results, when obtained, in respect to the power developed in proportion to the coals consumed.

Fig. 5.—End elevation of Boilers.



The screws of the *Pembroke* class are overhung; and, contrary to the usual practice in the Royal Navy, there are no screw-wells for the purpose of raising the screw out of the water. The reason of this, we presume, is that *time* could not be allowed to make this change in the ship.

The outer bearings of these ships are lined with *lignum vitæ*. We shall watch this novelty with some anxiety.

The *Pembroke's* screw is 12 feet diameter, and 12 feet pitch.

For the Journal of the Franklin Institute.

Improved Friction Hammer. By James Kitson Leeds, Esq.

In the July number of the Journal, at page 35, a full description with engraving is given of the above hammer. I wish to inform the readers of the Journal that a hammer, identically the same, was patented in this country by Mr. George E. Sellers, of Cincinnati, in January, 1844, and that a hammer was built under the patent by the Novelty Works, in New York, for the Atlantic Forge of that city, and that after repeated trials, it was abandoned, and a Nasmyth steam hammer, built by Merrick & Sons, of this city, substituted in its place. B.

For the Journal of the Franklin Institute.

Champion's Improvements in Feeding and Circulating Water in Boilers, etc.

Under the above head, Mr. Champion, at page 43 of the July number of the Journal, uses the following language in relation to his improvements:—

"m m, are conduits for leading the products of combustion from the flues up the stack while the damper o is open, and the fire is kindling and steam is raising, but when steam is up, the damper and ash pit closed, and the engine running, then the exhaust forces all down the

stack beneath the grate, and up through the fire round and round, saving and burning all the heat, smoke, gas, and exhaust steam."

Not being acquainted with such subjects, I wish to inquire if all Mr. Champion says can be true, if he can burn all the *heat*, *smoke*, *gas*, and *exhaust steam*, it appears to me that there is but little left for science to accomplish. The united steam power of this city requires, daily, the water of a small stream for its supply. If Mr. C. can burn this steam in the manner he says, does he not, literally, set the river on fire? X.

For the Journal of the Franklin Institute.

The Caloric Engine.

We learn that Captain Ericsson is still at work perfecting his improvements in this engine. A pair of engines are nearly completed at the establishment of Messrs. Birkbeck, Furman & Co., in New York. As soon as they are finished, we understand that it is the intention of Capt. E. to invite such engineers as have the confidence of the country, to make such tests as they may consider satisfactory, for the purpose of fully demonstrating the advantages or defects of the system which he has brought forward and advocated with so much zeal for the past few years.

Z.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 19th, 1855.

John C. Cresson, President, in the Chair.

Thomas Becherton, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Letters were received from the Imperial Royal Geological Society, in Vienna, and from Charles F. Loosey, Esq., of New York.

Donations to the Library were received from The Royal Astronomical Society; The Society of Arts, and the Statistical Society, London; The Royal Irish Academy, Dublin; The Imperial Royal Geological Society, Vienna, and from Mr. Theophilus P. Code, and Mr. Edward Smith.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for June was read.

The Board of Managers and Standing Committees reported their minutes.

The candidates for membership in the Institute, (2,) were proposed, and the candidates proposed at the last meeting, (7,) were duly elected.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on T. J. Weygandt's Galvanometer.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, an "Improvement in Galvanometers" invented by Mr. T. J. Weygandt, of Philadelphia, Pennsylvania—REPORT:

That they have carefully examined the galvanometer made by Mr. T. J. Weygandt for Professor Boyé, of the Philadelphia High School, and exhibited at the meeting of the 15th of March.

The principal novelty is in the construction of the pole changer, which gives great facility in working, and allows the coil and divided circle to be turned freely around without altering the position of the pole changer or disturbing the needle.

The instrument rests upon a flat circular wooden stand about 9 inches in diameter, which is supported on three levelling screws. On one side of the stand are the two binding screws for the reception of the wires from the thermo-pile or the metals to be experimented upon, the wires running from them to the keys of the pole changer, which is situated diametrically opposite to the binding screws on the stand.

From the centre of this stand rises the brass centre, upon which the circular glass box containing the coil and graduated circle turns with a very steady motion. The two needles are suspended by a human hair from a hook at the top of the instrument, which is arranged so as to be very nicely adjusted for the twist and for its height in the coil.

The coil, needles, and graduated circle are enclosed in a glass box, the plate on the top of which has a small hole in the centre, through which the suspending hair passes; the hair being protected by a glass tube, the top of which is supported by the long brass standards which carry the suspending hook. By this arrangement the graduated circle can be read through a plane flat glass instead of through the side of the glass cylinder as frequently constructed.

The inner wire of the coil comes down to a brass ring, which is fixed to the underside of the bottom of the revolving box. Concentric with this ring and in the same plane, at the distance of half an inch, is another brass ring, which is connected through the axis with the wire from the outside of the coil. These two rings thus form the extremities of the coil, and the pole changer plays between them. The wires from the binding screws are attached to two brass slips which terminate in pieces pressed by a spring against the inner ring, so that when the pieces are in their normal position, the current from the binding screws passes through the short space of ring between them and does not go through the coil, but when either of the pieces is withdrawn from the inside ring and pressed against the outside ring, the current passes through the coil, and by altering their position again, bringing that one which was against the inside ring in contact with the outside ring, and that which was in contact with the outside against the inside ring, the direction of the current is changed and the needle deflected in the opposite direction.